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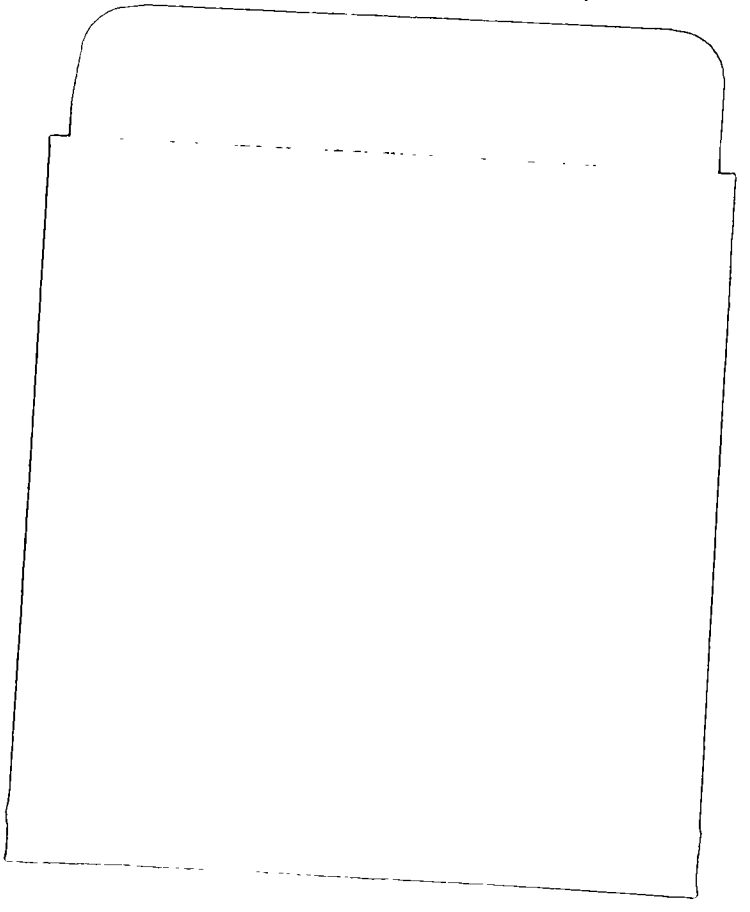
FM 3-8

DEPARTMENT OF THE ARMY FIELD MANUAL

CHEMICAL CORPS REFERENCE HANDBOOK

HEADQUARTERS, DEPARTMENT OF THE ARMY
APRIL 1963



FIELD MANUAL
No. 3–8

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., *7 May 1963*

CHEMICAL CORPS REFERENCE HANDBOOK

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*This manual supersedes FM 3–8, 14 February 1955, including C 1, 16 June 1955; C 2, 7 July 1955; C 3, 6 October 1955; C 4, 28 December 1955; C 5, 11 July 1956; C 6, 15 November 1957; C 7, 8 October 1958; C 8, 4 March 1959; and C 9, 5 October 1959.

CHAPTER 1

INTRODUCTION

1.1. Purpose and Scope

a. This manual provides statistical information and data for use in planning and providing chemical support. While it is primarily intended as a guide and reference handbook for chemical staff officers, it will be useful for personnel at all levels.

b. The manual contains a compilation of logistical and technical information pertaining to Chemical Corps materiel, services, operations, and units.

c. The material presented in this manual is applicable to nuclear and nonnuclear warfare.

1.2. Sources of Information

a. Appendix I lists some of the publications which were used as source material in developing the data presented in this manual. It was necessary in some instances to acquire the data from sources not readily available in the field.

b. While the data in this manual are based on the latest publications available at the time of preparation, actual computations in the field should be adjusted in accordance with subsequent changes to the pertinent source publications. Computations should also be adjusted when more accurate planning data are available through experience.

1.3. Relation to Other Manuals

This manual is intended to supplement FM 101–10, which contains planning data for staff officers at all echelons. Users of this manual who desire more detailed data should consult the appropriate tables of organization and equipment, field manuals, technical manuals, technical bulletins, and supply bulletins as outlined in DA Pams in the 310-series. It will be noted that this manual is limited to the summarizing of pertinent information from these sources. In many instances reference is merely made to the appropriate authoritative publication to be consulted, since it would serve no useful purpose to repeat the data in this manual. This would especially be true when the data are in a constant state of change.

1.4. Changes and Revisions

Users of this manual are encouraged to submit recommended changes or comments to improve the manual. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be forwarded direct to the Commandant, U.S. Army Chemical Corps School, Fort McClellan, Ala.

CHAPTER 2

ORGANIZATION

Section I. GENERAL

2.1. Types of Units

a. Regular TOE Unit. A regular chemical TOE unit is one that is regularly constituted and activated in accordance with an approved table of organization and equipment. FM 3–50 and FM 3–85 contain the detailed guidance concerning the operation of chemical units.

b. Cellular TOE Unit. A cellular chemical unit (detachment, platoon, or company) is composed of teams provided by the chemical service organization (TOE 3–500), with or without mess, automotive maintenance, and machine record stock accounting teams provided by the composite service organization (TOE 29–500). Each cellular unit is organized to meet a special requirement, and each team of the unit includes personnel and equipment required for the performance of a specific function. FM 3–85 contains a more detailed discussion of these units.

2.2. Unit Categories

a. Category I Unit. A unit organized under TOE whose mission includes the seizing and holding of ground, in addition to that of destroying the enemy. This category also includes those units whose mission is to assist in enemy destruction through support of ground-gaining troops by fire or other tactical support. These units habitually operate in the forward portion of the active combat area.

b. Category II Unit. A unit organized under TOE whose mission includes support and assistance of a nontactical nature to category I units in the forward active portion of the combat area. It is found habitually forward of the army rear boundary and is normally assigned to division, corps, or army.

c. Category III Unit. A unit organized under TOE whose mission includes service and operations in support of a combat area and the operating agencies of a communications zone. The unit is found normally in the communications zone or along the lines of communication leading to it, including the continental United States.

2.3. Type B Strength Column (TOE)

A column in the personnel section of a table of organization and equipment which authorizes only the minimum of United States military command, supervisory, technical, and necessary maintenance personnel positions required to perform the stated mission of the unit when augmented by available non-United States personnel. The capabilities of a type B unit are the same as those of a full strength unit. The number of non-United States personnel required for a type B unit is determined by the major commander to which the unit is assigned and depends upon the capacity of available personnel to produce, the number of work shifts, and other local conditions. Interpreters and translators for a type B unit are provided from teams available to the theater commander.

2.4. Chemical Staff Sections

Information pertaining to the organization and functions of chemical staff sections may be found in FM 101–5.

2.5. Planning Data

The data contained in the following sections of this chapter are the minimum needed by chemical planners. Additional data can be obtained from the appropriate TOE.

2.6. Regular TOE Units

Designation, TOE No., and date	Strength			Category	Mobility (percent)	Normal assignment	Basis of allocation[a]	Capabilities and remarks[b]
	Full	Reduced	Type B					
Hq & hq det, cml gp, 3–32E, 27 Jul 61, w/consolidated change, 1 Dec 61.	50	43	No	II	50	Assigned to field army or COMMZ; may be attached to Logistical Command B or C.	1 per type field army or COMMZ.	Provides command, control, staff planning, supervision of operations, and administration of 3 to 7 Chemical Corps battalions or Chemical Corps units. Dependent upon other units for mess, medical support, and supplemental motor maintenance.
Hq & hq det, cml bn, svc, army or COMMZ, 3–36E, 7 Mar 61, w/consolidated change, 1 Dec 61.	31	24	No	II	60	Assigned to army, independent corps, or a theater army logistical command. Normally attached to Logistical Command B or C.	1 per 3 to 7 companies.	Provides command, control, staff planning, and administration for attached units consisting of 3 to 7 companies. Dependent upon other units for mess and motor maintenance.
Cml co, combat spt, 3–7D, 26 Sep 57, w/C1, 18 Jul 60, and consolidated changes, 18 Aug 59 and 1 Dec 61.	246	160	No	II	100	Normally assigned to army and attached to corps.	1 per corps	At full strength provides six platoons for corps support: *a.* Each platoon can provide the following services for a combat division or for corps troops on priority as established by the commander of the supported unit when issued appropriate equipment on a special basis: operation and fuel support of eight smoke generators; production of smoke by smoke pots; servicing of portable and mechanized flamethrowers and preparation of flame field expedients; preparation of flame and toxic chemical minefields within capabilities, and supervision of other troops in preparing toxic minefields. *b.* Each platoon can provide the following services for a combat division or for corps troops with organic equipment on priority established by the supported unit commander: CBR

								monitoring, survey, and reconnaissance to include radiological fallout surveys; limited decontamination of critical areas and materiel and supervision of unit decontamination; operation of one personnel decontamination station; advice and supervision concerning field impregnation; assistance in training division personnel and units in CBR operations. *c.* Each platoon can provide the following services for a combat division or for corps troops on a continuing basis: chemical technical intelligence; third echelon maintenance of division organic Chemical Corps equipment; operation of a division chemical supply point. The company is dependent upon other units for religious and medical support. When operating separately, platoons are dependent upon other units for mess.
Cml gen spt co, 3-147E, 24 Jan 62.	131	Not adaptable.	No	II	c75	Assigned to field army; may be attached to corps. May be further attached to hq & hq det, cml bn, svc, TOE 3-36, for administration, rear area defense, and damage control.	1 to 4 per corps.	Provides the following facilities for approximately one-third of the corps chemical general support requirements (approximately 45,000 troops): receives, classifies, stores, issues, and ships Chemical Corps class II, IV, and V supplies; performs field maintenance on all Chemical Corps equipment; provides CBR decontamination of critical areas and materiel; is adaptable for firefighting and mobile shower service; expedites the flow of captured enemy CBR materiel and all pertinent reports for intelligence purposes. Dependent upon other units for religious and medical support.
Cml maint co, 3-47E, 1 Mar 61.	99	83	78	II	90	Assigned to army, independent corps, or theater army logistical command. May be attached to hq & hq det, cml bn, svc, TOE 3-36.	2 per type field army and 1 per independent corps or 1 per 100,000 troops.	Performs direct, general, and depot support maintenance on all Chemical Corps equipment utilized by 100,000 troops. Dependent upon other units for religious and medical support.

See footnotes at end of table.

2.6. Regular TOE Units—Continued

Designation, TOE No., and date	Strength			Category	Mobility (percent)	Normal assignment	Basis of allocation[a]	Capabilities and remarks[b]
	Full	Reduced	Type B					
Cml depot co, 3-67D, 10 Sep 57, w/consolidated changes, 18 Aug 59 and 1 Dec 61.	144	103	81	II	80	Assigned to army or independent corps. May be attached to hq & hq det, cml bn, TOE 3-36.	2 per type field army and 1 per independent corps or 1 per 100,000 troops.	Supplies Chemical Corps munitions and equipment for 100,000 troops; each platoon is capable of operating independently. Dependent upon other units for religious and medical support.
Cml proc co, 3-77E, 7 Dec 59.	93	56	39	III	10	Assigned to a section of the COMMZ.	1 company per 100,000 troops.	Processes approximately 36,000 2-layer uniforms per month when operating continuously from a fixed installation in the COMMZ. Platoons are capable of separate operations. Dependent upon other units for religious and medical support.
Cml lab, 3-97D, 30 Jan 58, w/consolidated changes, 18 Aug 59 and 1 Dec 61.	52	36	No	III	30	Assigned to theater of operations.	1 or more per theater of operations as required.	Performs chemical and physical operations for the laboratory examination, evaluation, and identification of materiel with primary emphasis on chemical, biological (except identification), and radiological aspects; conducts studies, experiments, or research projects pertinent to other than CBR materiel. Dependent upon other units for mess, motor maintenance, supplemental transportation, religious support, and local security of installations against hostile ground attack.
Cml depot co, COMMZ, 3-117E, 9 Feb 62.	73	60	37	III	Fixed	Assigned to COMMZ; attached as required.	1 per 200,000 total troops or major fraction thereof in the theater.	When labor personnel are furnished by QM service troops or from other labor sources, depending upon workload, this company is capable of receipt, storage, surveillance, and issue of Chemical Corps class II, IV, and V supplies in the COMMZ. Dependent upon other units for medical and religious support, transportation for materials handling equipment, labor sources, and local security of installa-

								tions against hostile ground attack.
Cml decon co, 3–217E, 13 Nov 61.	115	94	46	II	100	Assigned to army or COMMZ as required. May be attached to hq & hq det, cml bn, TOE 3–36.	2 per COMMZ supporting a type field army or 1 per 100,000 troops in the COMMZ and 1 per type field army.	Provides CBR decontamination service for approximately 100,000 troops; is adaptable for firefighting and mobile shower service. When issued smoke pots can perform limited camouflaging of service area by use of smoke. Dependent upon other units for medical and religious support.
Hq & hq det, cml smoke genr bn, 3–266E, 16 Feb 61, w/consolidated change, 1 Dec 61.	22	18	No	I	100	Assigned to army or COMMZ as required.	4 per type field army; to COMMZ as required.	Provides technical and operational supervision and administrative command for 3 to 8 chemical smoke generator companies. Dependent upon other units for mess, medical and religious support, and supplemental transportation.
Cml smoke genr co, 3–267E, 16 Feb 61.	142	101	89	I	100	Assigned to army and COMMZ as required. May be attached to hq & hq det, cml smoke genr bn, TOE 3–266.	16 per type field army; to COMMZ as required.	Provides blanketing of an area from 1 to 2½ miles in width and several miles in length, depending upon weather conditions, and is capable of rapid emplacement and displacement. Dependent upon other units for medical and religious support.

[a] Basis of allocation is based on the appropriate TOE and the latest troop requirements for the type field army (FM 101–10).

[b] With the exception of the cml lab and the cml depot co, COMMZ, these units have a limited capability to defend themselves and their installations against hostile ground attack. However, the effect of security operations on the units' missions must be considered.

[c] See paragraph 3.5.

2.7. Characteristics of Chemical Service Organization (TOE 3–500E, 8 MAY 1962) Teams[1]

Type	Strength		Capability	Basis of allocation
	Full	Reduced		
Administrative and Headquarters Teams				
Team AA, Platoon Headquarters (Component).	2	2	Provides command and administrative control of one or more teams.	One per one or more teams of a strength of not less than 40 individuals which operate as a component of a larger administrative organization.
Team AB, Platoon Headquarters (Separate).	4	4	Provides command and administrative control of one or more teams which operate separately.	One per one or more teams which operate separately. Units normally are composed of more than one team and/or have a strength of not less than 40 individuals.
Team AC, Company Headquarters.	6	6	Provides command and administrative control of two or more platoons.	One per two or more platoons except that the company strength shall not be less than 100 individuals.
Supply Teams				
Team BA, Supply	18	12	*At full strength* receives, classifies, stores, and issues class II, IV, and V chemical supplies and equipment for 5,000 to 10,000 troops. *At reduced strength* provides facilities for approximately 5,000 troops.	Assigned as required.
Team BB, Supply	37	27	*At full strength* receives, classifies, stores, and issues class II, IV, and V chemical supplies and equipment for 25,000 to 50,000 troops. *At reduced strength* provides facilities for 10,000 to 25,000 troops.	Assigned as required.
Maintenance Teams				
Team EA, Maintenance	20	17	*At full strength* provides chemical field maintenance support for 5,000 to 10,000 troops. *At reduced strength* provides facilities for approximately 5,000 troops.	Assigned as required.
Team EB, Maintenance	48	32	*At full strength* provides chemical field maintenance support for 25,000 to 50,000 troops. *At reduced strength* provides facilities for 10,000 to 25,000 troops.	Assigned as required.
Decontamination Teams				
Team FA, Decontamination	22	8	*At full strength* provides decontamination of critical areas and materiel for 5,000 to 10,000 troops. *At reduced strength* provides facilities for approximately 5,000 troops.	Assigned as required.
Team FB, Decontamination	41	41	Provides decontamination of critical areas and materiel for 10,000 to 25,000 troops	Assigned as required.
Technical Intelligence Teame.				
Team GA, Technical Intelligenc	10	10	Collects enemy CBR materiel, evaluat-	Assigned to theater of opera-

See footnote at end of table.

2.7. Characteristics of Chemical Service Organization (TOE 3–500E, 8 MAY 1962) Teams[1] —Continued

Type	Strength		Capability	Basis of allocation
	Full	Reduced		
			ing its components, use, and effectiveness, and instructing troops in its handling, use, and maintenance when required selects and expedites the flow of captured enemy CBR materiel and pertinent reports for intelligence purposes; locates, evaluates, and exploits those aspects of enemy installations pertinent to the design, construction, research, production, or storage responsibilities of Chemical Corps materiel.	tions as required by subordinate commander to assist the staff chemical officer in fulfilling his technical and scientific intelligence responsibilities.
Mobile Laboratory Team				
Team HA, Mobile Laboratory	20	20	Provides laboratory examination, evaluation, and identification of CBR materiel; develops temporary devices and measures for chemical operations; provides laboratory assistance toward solution of problems of a chemical nature.	Two mobile laboratory teams normally assigned to COMMZ in support of field army.
Munitions Safety Control Team				
Team IA, Munitions Safety Control.	8	5	*At full strength* provides inspection, evacuation, escort, demilitarization, destruction, deactivation, safety and security services for Chemical Corps munitions and related items. *At reduced strength* provides munitions handling and demolition personnel. The heavy transport capability is reduced.	Assigned as required.
CBR Center Team				
Team JA, CBR Center	5	5	Operates one CBR center or element in which the following operations are performed: implementation of CBR plans; analysis of targets for attack with chemical and biological agents; prediction of fallout from enemy and friendly nuclear strikes, including both the casualty-producing effectiveness of and the degree of hazard from chemical and biological attacks; control and coordination of CBR surveys; maintenance of CBR situation maps; dissemination of CBR information and similar data. Can augment division, corps, and army CBR centers or operate a minimum CBR center in rear area operations.	Assigned as required.

[1]This TOE is not adaptable to Type B organization. Mess teams and automotive maintenance teams will be drawn from TOE 29–500. The degree of mobility must be computed for each specific combination of cellular teams and/or composite units to be used. The teams depend upon other organizations for local security of installations against hostile ground attack. This table does not reflect TOE changes published after 15 May 1962.

2.8. Regular TOE Units

This paragraph does not reflect TOE changes published after 15 May 1962.

Equipment (full strength)	Hq & hq det, cml gp (3-32E)	Hq & hq det, cml bn, svc (3-36E)	Cml combat spt co (3-7D)	Cml gen spt co (3-147E)	Cml maint co (3-47E)	Cml dep co (3-67D)	Cml dep co, COMMZ (3-117E)	Cml proc co (3-77E)	Cml lab (3-97D)	Cml decon co (3-217E)	Hq & hq det, smoke genr bn (3-266E)	Cml smoke genr co (3-267E)
Chemical												
Adapter, line filling, one-tone container						6	5					
Apparatus, filling, field, landmine				2		6						
Beam, hoisting, airplane smoke tank						6						
Beam, hoisting, liquid gas tank						3	3					
Compressor, reciprocating, power-driven, 7 CFM			18									
Decontaminating apparatus, power-driven, trailer-mtd, 200-gal			12									
Decontaminating apparatus, power-driven, truck-mtd, 400-gal				5						12		
Detector kit, chemical agent	1	1	37	1	1	3	4	2	1	16	1	3
Dispensing pump, hand-driven				1		3	1					
Filling line, metal, airplane smoke tank						6	5					
Generator, smoke, mechanical, pulse jet												48
Heater, water, oil				5						6		
Hoisting unit, tripod, drum			6			3						
Impregnating plant, clothing								2				
Indicator, outlet valve leakage				1								
Laboratory, chemical, base									1			
Maintenance and repair set, Chemical Corps equipment				1	1							
Mask, gas, all-purpose									5			
Mask, protective, field [a]	50	31	246	131	99	144	73	93	52	115	22	142
Mechanism, valve replacement						3	2					
Mixing and transfer unit, incendiary oil			6									
Respirator, air filtering, paint spray		2	2	6	6	2	2			2		2
Sampling kit, chemical agent										1		
Service kit, portable flamethrower—riot control agent disperser			18									
Testing kit, impregnite-in-clothing			60									
Vulcanizer, hot patch, protective mask faceblank				1								
Wrench, valve-removing, M1						3	2					
Wrench, valve-removing, M2						3	2					
Engineer												
Boom, crane, truck-mtd, 25 ft, 2-ton						3						

Boom, crane, truck-mtd, 30 ft, 10-ton							1					
Compressor, reciprocating, power-driven, air, receiver-mtd, gas-driven, 5 CFM, 175 psi				1	1							
Crane-shovel, truck-mtd, abn, 3-ton, ⅜ cu yd						3						
Crane-shovel, truck-mtd, 20-ton, ¾ cu yd							1					
Generator set, .15 kw, skid-mtd											1	
Generator set, 0.5 kw, skid-mtd	1											
Generator set, 1.5 kw, skid-mtd		1		2	1			1				
Generator set, 3 kw, skid-mtd	1											
Generator set, 5 kw, skid-mtd							2		3			
Generator set, 10 kw, skid-mtd					1		1					
Generator set, 30 kw, skid-mtd								4				
Light set, chart, field, portable, command post										1	1	1
Light set, gen illuminating, 25 outlet	2	1		1	1		3	1	3			
Pump, centrifugal, 55 GPM								2				
Pump, centrifugal, 166 GPM				1						3		
Spray outfit, paint, 2 guns w/compressor				1	1							
Sprayer, insect, pushcart-mtd										3		
Sprayer, insect, skid-mtd				5						3		
Supplementary equipment, depot							1					
Tank, fabric, collapsible, 3,000-gal				1				2		3		
Toolkit, blacksmith's, gen				1	1							
Toolkit, carpenter's, engr squad	1			2	1		1	2			1	1
Toolkit, carpenter's, set 3			24									
Toolkit, pipefitter's, gen				1	1			2	1			
Toolkit, pipefitter's, supplemental								2				
Water purification equipment set, 900 GPH									1			
Welding shop, cargo, trailer-mtd, 300 amp				1	1							
Ordnance												
Automobile, sedan, light									1			
Carbine, cal .30			181			112						
Gun, machine, cal 7.62-mm		1	6	3		2	2			4		5
Gun, machine, cal .50	1			1			1					3
Gun, submachine, cal .45			7			5						
Launcher, rocket, 3.5-in	1	1	5	1		2	1			1		4
Pistol, cal .45	6	3		1	1		1	1	3	1	2	1
Rifle, 7.62-mm	43	28		130	98		72	92	[b] 49	114	20	141
Rifle, cal .30, M1			58			27						
Semitrailer, low bed, 15-ton				2								
Shop set, field maint, machine, basic				1	1							
Shop set, field maint, machine, hv, No 1, supplemental				1	1							
Toolkit, autmv, fuel and electric system, repairman				1	1							

See footnotes at end of table.

2.8. Regular TOE Units—Continued

Equipment (full strength)	Hq & hq det, cml gp (3-32E)	Hq & hq det, cml hn, svc (3-36E)	Cml combat spt co (3-7D)	Cml gen spt co (3-147E)	Cml maint co (3-47E)	Cml dep co (3-67D)	Cml dep co, COMMZ (3-117E)	Cml proc co (3-77E)	Cml lab (3-97D)	Cml decon co (3-217E)	Hq & hq det, smoke genr bn (3-266E)	Cml smoke genr co (3-267E)
Toolkit, electrician's, No. 1					3		1					
Toolkit, electrician's, No. 2								2	1			
Toolkit, gen mechanic's (toolkit, autmv maint)	1	1	49	18	18	2	3	6		2	1	5
Toolkit, org maint, No. 1, common			1	1	1	1	1			1		1
Toolkit, org maint, No. 1, supplemental			1	1	1	1	1			1		1
Toolkit, org maint, No. 5, oxygen-acetylene								2				1
Toolkit, org maint, No. 7, hoist and towing			1	1		1					1	1
Trailer, amph, cargo, ¼-ton	8	4	14	4	1	3				4	3	29
Trailer, cargo ¾-ton			24	1			1				2	
Trailer, cargo, 1½-ton	1	1	12	16	6	3	2			16	1	11
Trailer, tank, water, 1½-ton			1	1	1	1	1			1		3
Truck, cargo, ¾-ton, 4 x 4			24		3		3			3	2	3
Truck, cargo, ¾-ton, 4 x 4, w/winch				1	1							
Truck, cargo, 2½-ton, 6 x 6	1	1	19	6	5	7	6	3		4	1	8
Truck, cargo, 2½-ton, 6 x 6, w/winch			7	5	1	1	1		1	1		7
Truck, tractor, 5-ton				2								
Truck, utility, ¼-ton, 4 x 4	8	4	14	4	1	4		1	1	4	3	29
Truck, van, shop, 2½-ton, 6 x 6				2	2							
Quartermaster												
Can, gasoline, 5-gal	[c] 27	[c] 13	[c] 218	[c] 106	[c] 46	49	[c] 51	[c] 123	8	[c] 62	[c] 13	[c] 222
Can, water, 5-gal	[c] 10	[c] 6	[c] 16	[c] 9	[c] 7	28	[c] 5	[c] 19	10	[c] 8	[c] 4	[c] 9
Crane, whs, mobile, gas, 10,000-lb capacity				1			2					
Machine, sewing, hv duty, electric				2	4							
Machine, shoe patch, electric					1							
Tank and pump, liquid dispensing, truck-mtd												2
Tent, command post	2		1	1			1	1		1	1	1
Tent, gen purpose, medium	5	1	12	1			1			1	1	
Tent, maint				4	2							1
Tent, wall, large		3		5	2	4	3			2		
Tent, wall, small	1											
Toolkit, carpenter's, engr plat		1				3			1	1		
Tractor, whs, 4,000-lb, 144-in. lift							1					
Trailer, whs, 6,000-lb							4					
Truck, fork, 6,000-lb, rough terrain				1			1					
Truck, fork, 10,000-lb, rough terrain							1					

Signal												
Anemometer, ML–497/PM											1	3
Camera, still picture, KS–4									1			
Charger, radiac detector, PP–630/PD			30			1			1			
Charger, radiac detector, PP–1578A/PD	2	2		2	2		1	2		4	2	2
Cipher machine, TSEC/KL–7	1	1									1	1
Cipher machine, TSEC/KW–9	1											
Photographic equipment, PH–383									1			
Radiacmeter, IM–93/UD	6	6	144	8	6	5	2	6	2	14	6	8
Radiacmeter, IM–147/PD			144									
Radiacmeter, IM–174/PD	4	4		2	4		2	4	2	5	4	4
Radiac set, AN/MDQ–1									1			
Radiac set, AN/PDR–27			48		1							
Radiac set, AN/PDR–39			48			1						
Radio set, AN/GRR–5					1							
Radio set, AN/VRC–9	1		18	4						3		8
Radio set, AN/VRC–17				2	4					1	2	1
Radio set, AN/VRQ–2		1	2								1	1
Switchboard, telephone, manual, SB–22/PT	1	1		1	1	1	1				1	1
Telephone set, TA–312/PT	6	6	8	10	5	4	6	3	1	4	5	20
Teletypewriter set, AN/PGC–1	1											
Terminal telegraph-telephone, AN/TCC–14	1											
Toolkit, photographic repairman, TK–77/GFM									2			
Wind measuring set, AN/GMQ–11											1	

[a] Authorized by TA 20–11.
[b] Selective auto semiautomatic.
[c] Authorized by TA 10–100.

2.9. Chemical Service Organization (TOE 3–500E)

This paragraph does not reflect TOE changes published after 15 May 1962.

Equipment	Team																	
	Admin & Hq			Supply				Maintenance				Decon			Tech Intel	Mbl Lab	Mun Safety Con		CBR Cen
	AA	AB	AC	BA		BB		EA		EB		FA		FB	GA	HA	IA		JA
				Full	Red.	Full	Red.	Full	Red.	Full	Red.	Full	Red.				Full	Red.	
Chemical																			
Adapter, line filling, one-ton container				2	2	4	2												
Analyzing kit, chemical agent															2	1			
Beam, hoisting, airplane smoke tank				2	2	4	2												
Beam, hoisting, liquid gas tank				2	1	3	2												
Calibrator, radiac, TS–1230(U)/PD																	1	1	
Decontaminating apparatus, power-driven, truck-mtd, 400-gal												3	1	6					
Detector kit, chemical agent		1	1	1		1	1	1	1	1	1	3	1	6	2	3	2	2	
Dispensing pump, hand-driven				1	1	2	1												
Filling line, airplane smoke tank				2	2	4	2												
Hoisting unit, tripod, drum				1	1	1	1												
Laboratory, chemical, mobile, M3																1			
Maintenance and repair set, Chemical Corps equipment								1	1	1	1								
Mask, protective, field [1]	2	4	7	18	12	37	27	20	17	48	32	22	8	41	10	20	8	5	5
Mechanism, valve replacement				1	1	1	1										1	1	
Respirator, air filtering, paint spray										6	6								
Sampling kit, chemical agent															2	1			
Service kit, gas bomb																	1	1	
Wrench, valve-removing, M1				1	1	2	1										2	2	
Wrench, valve-removing, M2				1	1	2	1										2	2	
Engineer																			
Compressor, power-driven, 5 CFM								1	1	1	1								
Generator set, 1 ph, 120 volt, 1.5 kw			1	1	1	1	1	1	1	1	1					1			
Generator set, gasoline engine, 10 kw, skid-mtd						1	1												
Light set, gen illuminating, 25 outlet			1	1	1	1	1	1	1	1	1					1			
Pump, centrifugal, gas-driven, base-mtd, 166 GPM, 2 in., 25-ft. head												1	1	2					
Spray outfit, paint, w/compressor										1	1								
Supplementary equipment, depot						1													
Tank, fabric, collapsible, 3,000-gal												1	1	2					
Tool kit, carpenter's, engr plat		1	1	1				1	1			1	1	2	1	1			
Tool kit, carpenter's, engr squad						1	1												

Tool kit, pipefitter's, gen										1						1	1	1	
Tool kit, precision instrument repair								1	1	1	1								
Tool kit, sheet metal worker's, set No. 1																1			
Welding shop, trailer-mtd, 300 amp DC								1	1	1	1								
Ordnance																			
Demolition equipment, set																	1	1	
Gun, machine, 7.62-mm, lt wt, gen purpose		1	1																
Machine, blasting																	1	1	
Pistol, cal .45, semiauto			1																
Rifle, 7.62-mm, selective auto-semiauto, lt bbl	2	4	5	18	12	37	27	20	17	48	30	22	8	41	10	20	8	5	
Rifle, 7.62-mm, semiauto, lt bbl																			5
Semitrailer, van, cargo, 6-ton 2-wheel																	1		
Shop set, field maint, machine, basic								1	1	1	1								
Shop set, field maint, machine, hv, No. 1, supplemental										1									
Tool kit, autmv, fuel and electric system, repairman								1	1	1	1								
Tool kit, autmv maint (gen mechanic's)								4	3	8	5								
Tool kit, org maint, No. 1, common										1	1								
Tool kit, org maint, No. 1, supplemental										1	1								
Tool kit, org maint, set No. 5, oxygen-acetylene								1	1	1	1								
Tool kit, welder's								1	1	1	1								
Tool set, electrician's, 44 components (No. 1)				1		1	1												
Tool set, electrician's, No. 2																1			
Trailer, amph, cargo, ¼-ton			1	1	1	2	1	1	1	1	1	1	1	2	3	1	1	1	
Trailer, cargo, ¾-ton																			1
Trailer, cargo, 1½-ton				1	1	2	1	1	1	2	2	3	1	6	1	1			
Trailer, tank, water, 1½-ton		1	1																
Truck, cargo, ¾-ton, 4 x 4		1	1					1		2	2					1			1
Truck, cargo, 2½-ton, 6 x 6				2	2	4	2	1	1	2	2	2	1	4	1	1	1	1	
Truck, cargo, 2½-ton, 6 x 6, w/winch		1	1									1		2					
Truck, tractor, 2½-ton, 6 x 6																	1		
Truck, utility, ¼-ton, 4 x 4			1	1	1	2	1	1	1	1	1	1	1	2	3	1	1	1	
Truck, van, shop, 2½-ton, 6 x 6								1	1	2	1								
Quartermaster																			
Can, gasoline, 5-gal.[2]		5	10	10	8	15	11	15	12	26	21	18	8	36	11	10	7	5	3
Can, water, 5-gal.[2]	1	1	1	4	2	7	5	4	3	10	6	4	2	8	2	4	2	1	1
Machine, sewing, hv duty, electric								1	1	4	1								
Machine, shoe patch, electric								1	1	1	1								
Tent, command post																			1
Tent, maint shelter								2	2	2	2					1			
Tent, gen purpose, medium		1	1																
Tent, gen purpose, small		1	1	1	1	2	2			1					2	1			

See footnotes at end of table.

2.9. Chemical Service Organization (TOE 3–500E)—Continued

Equipment	Team																	
	Admin & Hq			Supply				Maintenance				Decon			Tech Intel	Mbl Lab	Mun Safety Con		CBR Cen
	AA	AB	AC	BA		BB		EA		EB		FA		FB	GA	HA	IA		JA
				Full	Red	Full	Red.	Full	Red.	Full	Red.	Full	Red.				Full	Red.	
Tool set, field maint, chemical munitions, No. 1																	1	1	
Tool set, field maint, chemical munitions, No. 2																	1	1	
Truck, lift, fork, 6,000-lb, rough terrain				1		1	1												
Signal																			
Charger, radiac detector, PP–1578A/PD		1	2									2	1	3	3				
Photographic equipment, PH–383															1	1			
Radiacmeter, IM–93/UD		2	2									6	2	12	10				
Radiacmeter, IM–156/PD																	1	1	
Radiacmeter, IM–174/PD		1	2									2	2	2	2				
Radiac set, AN/PDR–27												2	1	3	2				1
Telephone set, TA–312/PT	1	1	3	2	2	3	3	2	2	3	2				1	2			1

[1] Authorized by TA 20–11.
[2] Authorized by TA 10–100.

Section IV. CHARACTERISTICS OF COMPOSITE SERVICE ORGANIZATION TEAMS

(TOE 29–500D, 21 Feb 58, w/C1, 14 Nov 60, and consolidated changes, 18 Aug 59 and 1 Dec 61)

2.10. Characteristics and Vehicular Equipment[1]

Type	Strength				Capabilities	Vehicular equipment	Remarks
	O	WO	EM	Agg			
Mess Detachments							
Team CA, Unit Mess	0	0	4	4	Provides the minimum basic personnel and equipment necessary for the operation of a unit mess subsisting not more than 62 individuals.	1 truck, cargo, 2½-ton, 6 x 6. 1 trailer, tank, water, 1½-ton, 2-wheel.	
Team CB, Mess, Augmentation	0	0	1	1	Provides for the required augmentation of a unit mess with one team CB when additional individuals to be subsisted increase the unit strength in excess of 62. An additional team CB is authorized for each increase of 60 individuals or major fraction thereof in excess of 75 but not exceeding 195 individuals. An additional team CB is authorized for each increase of 75 individuals or major fraction thereof in excess of 195 but not exceeding 500 individuals. An additional team CB is authorized for each increase of 90 individuals or major fraction thereof in excess of the first 500. When a unit mess operates on a 24-hour basis and at least 15 percent of the rations are consumed at night, team CB or multiples of this team provide for the augmentation of a unit mess not to exceed one-third overstrength of total cooks authorized.	None	
Team CC, Mess, Augmentation.	0	0	1	1	Provides for the augmentation of a unit mess operating two or more separate echelon messes of a combined strength of more than 300 individuals.	None	
Automotive Maintenance Detachments, Wheel							
Team DA, Company Automotive Maintenance, Wheel.	0	0	1	1	Provides the minimum basic personnel and equipment necessary for the operation of an automotive maintenance section when servicing 12 wheel vehicles or 8 amphibious wheel vehicle equivalents or major fraction thereof.	1 truck, cargo, 2½-ton, 6 x 6.	See note at end of table.
Team DC, Battalion Automotive Maintenance, Wheel.	0	0	2	2	Provides the minimum basic personnel and equipment necessary for the operation by separate company, battalion, or higher unit of an automotive maintenance section when authorized 30 wheel vehicles or 12 amphibious wheel vehicle equivalents or major fraction thereof.	1 truck, cargo, 2½-ton, 6 x 6.	Team DC supplements teams authorized a company or smaller unit when not otherwise provided. See note.

See footnote at end of table.

2.10. Characteristics and Vehicular Equipment[1]—Continued

Type	Strength				Capabilities	Vehicular equipment	Remarks
	O	WO	EM	Agg			
Team DE, Wheel Vehicle Mechanic, Augmentation.	0	0	1	1	Provides for the augmentation of an automotive section of company or smaller unit with an automotive mechanic, not otherwise provided, for each 12 wheel vehicles or 8 amphibious wheel vehicle equivalents or major fraction thereof, based on the total authorized the unit.	None	Team DE supplements teams authorized a company or smaller unit when not otherwise provided. See note.
Team DG, Senior Wheel Vehicle Mechanic, Augmentation.	0	0	1	1	Provides for the augmentation of an automotive maintenance section with a chief, wheel automotive mechanic, not otherwise provided, for each four wheel vehicle mechanic authorized the unit when a fifth mechanic is required.	None	See note at end of table.
Team DI, Company Wheel Vehicle Motor Maintenance Sergeant.	0	0	1	1	Provides for the augmentation of an automotive maintenance section with an automotive maintenance sergeant, not otherwise provided, for company or smaller units when eight or more wheel vehicle mechanics are authorized the unit.	None	See note at end of table.
Team DK, Assistant Wheel Vehicle Motor Maintenance Sergeant.	0	0	1	1	Provides for the augmentation of an automotive maintenance section of a unit with an assistant automotive sergeant, not otherwise provided, when 16 or more wheel vehicle mechanics are authorized the unit.	None	See note at end of table.
Data Processing Detachments							
Team FA, Data Processing.	1	0	13	14	Provides the minimum basic personnel and equipment required for a one-shift operation of an electric accounting machine section handling 8,000 to 15,000 transaction lines per month.	None	Funding for items of data processing equipment is the responsibility of the major commander to whom the unit is assigned.
Team FB, Data Processing, Augmentation.	0	1	13	14	Provides for the required augmentation of team FA with a second shift when an electric accounting machine section is required to handle from 15,000 to 30,000 transaction lines per month.	None	Remark for team FA applies.

[1]The teams of this TOE are not adaptable to type B organization. The teams will be designated as category II or category III units, depending upon the organization to which attached and area of assignment.

Note. Basis of Allocation: Vehicle equivalents used in determining the number of motor vehicle mechanics required for performing automotive organizational maintenance upon general purpose, combat, special purpose, and special equipment vehicles powered by gasoline or pulled by a towing vehicle will be computed on the following basis:

	Vehicle Equivalents
a. Trailers	
(1) For cargo, personnel, or equipment up to 1½ tons, inclusive	0.1
(2) For cargo, personnel, or equipment over 1½ tons and up to 3½ tons, inclusive	.3
(3) For cargo, personnel, or equipment over 3½ tons and up to 15 tons, inclusive	.4
(4) For cargo or equipment over 15 tons	.8
b. Vehicles (except amphibian)	
(1) All motor vehicles up to 2½ tons, inclusive	1.0
(2) All motor vehicles over 2½ tons and up to 10 tons, inclusive	2.0
(3) All motor vehicles over 10 tons	3.5
c. Vehicle Amphibians	
2½ tons or over	3.5

CHAPTER 3

OPERATIONS

Section I. TROOP PLANNING

3.1. General

FM 101–10 contains a discussion on troop planning.

3.2. Troop Planning Slices

Troop planning slices and basic slice factors are also discussed in FM 101–10.

3.3. Troop Disposition

a. Type Field Army. Information indicating the number and types of chemical units that might be found in a type field army is given in FM 101–10, part I.

b. Theater of Operations. Troop requirement planning factors for a large theater of operations are given in FM 101–10, part III.

3.4. Balanced Force: Type Field Army Plus Communications Zone (3 Corps, 12 Divisions)

Branch or service	Division sector	Corps sector	Army sector	COMMZ sector	Theater total	Percent of theater total
Infantry	123,732	4,068	4,389		132,189	24.28
Armor	43,851	15,033	2,799		61,683	11.33
Air Defense Artillery		14,589	6,147	9,348	30,084	5.53
Field Artillery	[1] ( )	36,138	1,233		37,371	6.86
Aviation	[1] ( )	1,058	3,559		4,617	.85
Chemical		738	3,086	2,627	6,451	1.18
Engineer	[1] ( )	16,188	19,283	17,276	52,747	9.69
Medical	[1] ( )		14,134	25,636	39,770	7.30
Military Intelligence		207		114	321	.06
Military Police	[1] ( )	630	4,418	13,462	18,510	3.40
Ordnance	[1] ( )		29,320	17,377	46,697	8.58
Quartermaster	[1] ( )		10,653	19,977	30,630	5.63
Signal	[1] ( )	4,152	9,899	11,418	25,469	4.68
Transportation	[1] ( )	2,655	12,228	30,284	45,167	8.30
Miscellaneous [2]		1,656	4,528	6,493	12,677	2.33
Totals	167,583	97,112	125,676	154,012	544,383	100.00

Total Field Army—390,371.
Total Theater —544,383.

[1] Included in infantry and armored figures above.

[2] Includes finance, replacement, postal, data processing, psychological operations, linguist, photointerpretation, public information, special services, and civil affairs units.

Section II. TROOP MOVEMENTS

3.5. Movement of Chemical Units by Motor

a. References. Information pertaining to troop movement by motor vehicle is given in FM's 25–10, 100–5, 100–10, 101–5, and 101–10. Logistical information about military vehicles is given in TM 9–500 and TM 9–2800.

b. Mobile Unit. A mobile unit is a unit equipped with sufficient organic vehicles for the purpose of transporting all assigned personnel and equipment from one location to another at one time.

c. Chemical Unit Motor Movement Data. The following listing includes degrees of unit mobility, expressed in percentage, and vehicle requirements for movement of units, including personnel and individual and organization equipment. Teams of the chemical service organization (TOE 3–500) are not listed because the degree of mobility of cellular units must be computed for each specific combination of teams used.

Movement of Chemical Units by Motor

Unit (TOE)	Mobility (percent)	Remarks
Hq & hq det, cml gp (3–32E)	50	One additional, nonorganic, 2½-ton, 6 x 6 cargo truck required for 100 percent mobility. Unit can move w/o additional transportation by shuttling once with one organic, 2½-ton, 6 x 6 cargo truck.
Hq & hq det, cml bn, svc (3–36E)	60	One additional, nonorganic, 2½-ton, 6 x 6 cargo truck required for 100 percent mobility. Unit can move w/o additional transportation by shuttling once with one organic, 2½-ton, 6 x 6 cargo truck.
Cml maint co (3–47E)	90	Two additional, nonorganic, 2½-ton, 6 x 6 cargo trucks required for 100 percent mobility. Unit can move w/o additional transportation by shuttling once with two organic, 2½-ton, 6 x 6 cargo trucks.
Cml depot co (3–67D)	80	Two additional, nonorganic, 2½-ton, 6 x 6 cargo trucks required for 100 percent mobility. Unit can move w/o additional transportation by shuttling once with two organic, 2½-ton, 6 x 6 cargo trucks. Vehicular requirements for moving depot stocks are not included.
Cml depot co, COMMZ (3–117E)	Fixed	Two additional, nonorganic, 2½-ton, 6 x 6 cargo trucks, two 5-ton truck-tractors, and two 15-ton low-bed semitrailers are required for 100 percent mobility. Unit can move w/o additional transportation by shuttling once with organic transportation. Vehicular requirements for moving depot stocks are not included.
Cml lab (3–97D)	30	Ten additional, nonorganic, 2½-ton, 6 x 6 cargo trucks or equivalent required for 100 percent mobility. Impractical to shuttle unit with organic transportation.
Cml proc co (3–77E)	10	Twenty-three additional, nonorganic, 5-ton truck-tractors with 6-ton semitrailers, stake, and two 2½-ton, 6 x 6 cargo trucks required for 100 percent mobility. If movement on bridges, under trestles, or through tunnels precludes the use of 5-ton stakes, then impregnators and dryers should be loaded on low-bed semitrailers.
Cml gen spt co (3–147E)	75	Calculations indicate that this unit does not require additional vehicles for 100 percent mobility. Vehicular requirements for moving depot stocks are not included.
Hq & hq det, cml smoke genr bn (3–266E)	100	
Cml smoke genr co (3–267E)	100	
Cml decon co (3–217E)	100	
Cml combat spt co (3–7D)	100	

3.6. Weights and Dimensions of Organizational Equipment

Item	Uncrated					Crated						Remarks
	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)	Weight (lb)	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)	Weight (lb)	Number in container	
Chemical												
Adapter, line filling, one-ton container, M1.	----------	------	-------	----------	----------	21	15	12	2.2	104	8	
Analyzing kit, chemical agent, M10A1.	27	13	5	1.02	15	30	17	8	2.4	45	1	
Apparatus, filling, field, landmine, M2.	----------	------	-------	----------	----------	31	27¾	16	8.0	198	1	
Beam, hoisting, airplane smoke tank, M2.	32	------	-------	----------	----------	36	14½	4½	1.35	96	6	Also packed 2 per box, 0.63 cu ft, 42 lb.
Beam, hoisting, liquid gas tank, M1.	71	------	-------	----------	----------	84½	6½	10	3.2	192	1	
Compressor, reciprocating, power-driven, flamethrower, 3½ CFM, AN–M4.	----------	------	-------	----------	72	29¼	21¾	27	13.6	125	1	
Compressor, reciprocating, power-driven, 7 CFM, M1A1.	66	30	33	37.81	900	72	36	43	69.0	1,300	1	
Decontaminating apparatus, portable, 1½-qt, M2.	----------	------	-------	----------	----------	22	13	10	1.7	50	6	
Decontaminating apparatus, portable, DS2, 1½-qt, ABC–M11.	----------	4 (diam)	13	----------	3 (empty) 6 (full)	------	------	------	2.7	61	12	24 nitrogen (C11) cartridges included in package.
Decontaminating apparatus, power-driven, trailer-mtd, 200-gal., M8A2.	153.37	69	80	489.95	[a] 2,650							
Decontaminating apparatus, power-driven, truck-mtd, 400-gal., M9.	261	87	105	1,379.3	16,775	------	------	------	------	----------	------	Mounted on 2½-ton truck. Cubage of decontaminating apparatus is approximately 205 cu ft.
Decontaminating apparatus, power-driven, truck-mtd, M3A2.	252½	87	98	[a] 1,240	11,100	------	------	------	------	----------	------	Mounted on 2½-ton truck. Cubage of decontaminating apparatus is approximately 205 cu ft.

See footnotes at end of table.

3.6. Weights and Dimensions of Organizational Equipment—Continued

Item	Uncrated					Crated						Remarks
	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)	Weight (lb)	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)	Weight (lb)	Number in container	
Decontaminating apparatus, power-driven, truck-mtd, M3A3.	261	87	105	1,379.3	14,280	------	------	------	------	------	------	Mounted on 2½-ton truck. Cubage of decontaminating apparatus is approximately 205 cu ft.
Detector kit, chemical agent, ABC–M18A1.	8	6	3	.06	2.5	------	------	------	1.7	30	10	
Detector kit, chemical agent, M18.	8½	5½	3½	.095	2.5	30	15	7	1.8	43	8	
Detector kit, chemical agent, M9A2.	8½	5½	3½	.095	2.5	------	------	------	2.1	50	8	
Dispensing pump, hand-driven, M2A1.	------	------	------	------	------	56	18	11½	6.7	109	1	
Dispensing pump, hand-driven, M2	------	------	------	------	------	56	18	11½	6.7	109	1	
Filling line, metal, airplane smoke tank, M3.	------	------	------	------	------	67	10½	6	2.2	48	1	
Flamethrower, portable, ABC–M9–7.	22½	18 13/16	12¼	3.00	26	24 7/8	26½	14	6.8	64	1	Uncrated dimensions for tank group only.
Flamethrower, portable, M2A1–7.	27	20	11	3.44	39.5	33¾	22 7/8	18 5/8	8.2	108	1	Uncrated dimensions for tank group only.
Flamethrower, portable, M2A1.	27	20	11	3.44	43	33¾	22 7/8	18 5/8	8.2	112	1	Uncrated dimensions for tank group only.
Generator, smoke, mechanical, pulse jet, ABC–M3A3.	42¼	18½	23	10.4	163	51	23½	28½	19.77	243	1	
Heater, water, oil, M1:												
Water heating unit	62	30 (diam)	------	------	------	------	------	------	79.7	1,365	------	One unit in 2 boxes.
Full pressure unit	38	18 (diam)										
Heater, water, oil, skid-mtd, 600 GPH, M2.	------	------	------	------	------	49	15	32	13.6	950	1	
Hoisting unit, tripod, drum, M1.	114	------	------	------	------	139½	12	10½	9.4	188	1	
Impregnating outfit, clothing, field, M1.	------	------	------	------	------	28	13½	13½	2.9	72	1	
Impregnating plant, clothing, M2A1.	[a] 1,200	[a] 600	[a] 156	------	[a] 48,000	------	------	------	6,500	99,975	------	Packed in 11 crates.

Impregnating plant, clothing, M2.	[a] 1,200	[a] 600	[a] 156	----	[a] 48,000	----	----	----	7,146	89,535	----	Packed in 13 crates.
Impregnating set, clothing, field, M3.	----	----	----	----	----	23½	11½	11½	1.7	53	1	
Indicator, eyepiece leakage, M2.	29⅜	23⅝	20½	8.05	165	41½	28	23¾	17.0	225	1	
Indicator, outlet valve leakage, M4A1.	17	22	11	2.38	----	[a] 26	[a] 22	[a] 22	7.2	120	1	
Laboratory, chemical, base, M2.	----	----	----	----	----	----	----	----	1,356	22,029	----	Packed in 65 boxes.
Laboratory, chemical, mobile, M3.	----	----	----	----	----	----	----	----	145	3,158	----	Packed in 13 crates.
Maintenance and repair set, Chemical Corps equipment, M1A1.	----	----	----	----	----	----	----	----	104	2,589	----	Packed in 7 boxes and 1 bundle of 5 tabletops. Each crate has the approximate dimensions of 58½ x 39¼ x 29⅜ inches.
Mask, gas, all-purpose, M11A1.	----	----	----	----	----	29	16⅝	14⅜	4.4	74	6	
Mask, protective, field, M17, in carrier, w/ accessories.	10	----	7 to 8½	----	[a] 3.1	27½	19⅛	13⅝	4.1	58	10	10 per fiberboard container plus plywood box.
Mask, protective, field, M9A1, in carrier, w/ accessories.	9½	4½	12	.30	[a] 3.5	20¾	19¼	12⅞	3.3	56	6	Each mask packaged as a unit in a metal container. Six units are then packed in a wood box. Units may be packaged in fiberboard. The dimensions of the wood box with fiberboard units are 21⅜ x 16 11/16 x 13¾ inches.
Mechanism, valve replacement, M1.	----	----	----	----	----	39	38	16	13.7	375	1	
Mixing and transfer unit, incendiary oil, M5.	80	34	40	63.0	1,175	110	49	55	165	2,150	1	
Respirator, air filtering, paint spray, M5.	----	----	----	----	----	31	14	15	3.8	70	12	
Riot control agent disperser, helicopter- or vehicle-mtd, M4.	30	24	48	20.0	160	34⅛	29⅛	55⅞	31	312	1	

See footnotes at end of table.

3.6. Weights and Dimensions of Organizational Equipment—Continued

Item	Uncrated					Crated						Remarks
	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)	Weight (lb)	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)	Weight (lb)	Number in container	
Riot control agent disperser, helicopter- or vehicle-mtd, M5.	----------	24 (diam)	44	----------	150	-------	-------	-------	22	260	1	
Riot control agent disperser, portable, M3.	27	20	11	3.44	43	33 7/8	22	14 3/8	6.8	96	1	
Riot control agent disperser, skid-mtd, GED, 5,000 CFM, M2.	----------	-------	-------	----------	550	68 5/8	43 1/4	47 3/8	84.6	800	1	
Sampling kit, chemical agent, M12.	16	14	9	1.16	[a] 7	20 1/8	18 1/8	11 3/8	2.3	43	1	
Service kit, portable flamethrower—riot control agent disperser, M27.	24 1/4	18 1/2	11 5/8	3.2	85	[a] 34	[a] 23	[a] 19	[a] 8.6	[a] 115	1	
Service unit, flamethrower, truck-mtd, M4A1.	[a] 263	[a] 93	[a] 123	1,656	16,500							
Service unit, flamethrower, truck-mtd, M4.	[a] 263	[a] 93	[a] 123	1,656	16,500							
Smoke tank, airplane, M10.	84	20 1/2	14	13.9	68	87	18	30	23.5	177	1	
Testing kit, impregnite-in-clothing, M1.	6 1/2	4 1/2	1	.168	[a] 1	17 1/2	13 1/2	10 1/4	1.4	62	32	
Testing kit, impregnite-in-clothing, ABC-M2.	4 1/4	3 1/8	1 1/2	.01	.31	-------	-------	-------	1.0	23	60	
Vulcanizer, hot patch, protective mask face-blank, M1.	[a] 29	[a] 6 3/8	[a] 9 1/2	----------	----------	[a] 24	[a] 19	[a] 11	2.8	56	1	
Water testing kit, chemical agents, AN-M2.	6	2 1/2	3 1/2	.03	----------	21 3/4	17 3/4	22	1.0	50	24	
Water testing kit, poisons, M4A1.	21	17	8	1.65	----------	31 1/2	19 1/2	6 1/2	2.3	45	1	
Wrench, valve-removing, M1.	15	-------	-------	----------	----------	31	7	7	.9	52	5	
Wrench, valve-removing, M2.	15	-------	-------	----------	----------	31	7	7	.9	52	5	
Engineer												
Bag, water sterilizing, cotton, porous.	22	22	4 1/4	1.20	18.75	27	25	20 1/4	7.91	135.4	4	

Boom, crane, truck-mtd, 25 ft, 2-ton.									160.1	2,150		1
Compressor, reciprocating, power-driven, air, receiver-mtd, gas-driven, 5 CFM, 175 psi.	47¾	18½	49¼	25.9	488.10	52¾	23½	54¼	36.048	598		1
Crane-shovel, truck-mtd, 6 x 6, abn, 3-ton, ⅜ cu yd.	258	93	122	1,694.6					1,653.3	18,300		1
Crane-shovel, truck-mtd, 6 x 6, 10-ton, ½ cu yd.	476⅞	96	136¾	[a] 3,744						40,800		1
Detecting set, mine, AN/PRS-3.	26	12	11	2.0	51	29	13¾	12¾	2.942	62		1
Drafting and duplication equipment set No. 1.	23	18	8	1.9	69	25½	20	9¾	2.877	80		1
Extinguisher, fire, CO_2, 15-lb capacity.	7½	7½	32	1.042	48	19	9½	34	3.550	133		2
Extinguisher, fire, CCl_4, 1-gal.	7¼	7¼	23	.700	35	17¾	16¼	25¾	4.298	185		4
Extinguisher, fire pump, steel, 4-gal.	25	11½	11½	1.913	13	37½	14½	24½	7.696	188		8
Floodlight set, electric, portable, 6 floodlights, mast-mtd, 120–208 volt.									40.84	650	[b] ( )	
Floodlight set, electric, portable, 6-volt.									8.053	270	[b] ( )	
Generator set, gasoline engine, 0.15 kw, skid-mtd.	14	10¼	14½	1.20	32	18	13¼	18½	2.55	51		1
Generator, set, gasoline engine, 1.5 kw, skid-mtd.					114							
Generator set, gasoline engine, 5 kw, skid-mtd.	50	20	30	17.30	650	62¼	28	41¾	42.1	839		1
Generator set, gasoline engine, 10 kw, skid-mtd.									94.68	1,953		1
Generator set, diesel engine, 30 kw, skid-mtd.	108	37	71	164.0	4,800	122	45	83	263.8	5,785		1
Hoist, chain, hand, 1½-ton, 8 ft 6 in.				.931	76	30	14¾	6	1.536	92.9		1
Hook, block, 3-ton	33¾	15½	6½	1.960	235	36¾	17	8	2.896	264.3		1
Hook, block, crane or crane-shovel, 10-ton.	41	17½	6	2.491	250	44	19	7½	2.628	279		1
Hose, cotton, rubber-lined, 1½ in. x 25 ft.				.638	15	46½	23½	13¾	8.695	192.9		8

See footnotes at end of table.

3.6. Weights and Dimensions of Organizational Equipment—Continued

Item	Uncrated					Crated						Remarks
	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)	Weight (lb)	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)	Weight (lb)	Number in container	
Hose assembly, rubber-wrapped, 3–4 in. x 10 ft.	----------	-------	--------	.812	19.25	127	12½	9	8.338	165.5	6	
Hose assembly, rubber-wrapped, 3–4 in. x 50 ft.	----------	-------	--------	1.175	17	28	26½	27½	11.81	209	8	
Light set, gen illuminating, 25 outlet.	----------	-------	--------	----------	----------	-------	-------	-------	12.14	260	[b] ( )	
Pump, centrifugal, gasoline-driven, base-mtd, 55 GPM, 2 in., 50-ft head.	----------	-------	--------	14.2	250							
Pump, centrifugal, gasoline-driven, base-mtd, 115 GPM, 2 in., 25-ft head.	23½	21½	21	6.153	188.9	26½	23	22½	9.0	232	1	
Sign painting set No. 1	27½	17	18	5.167	88	30	18¼	19¼	6.113	131	1	
Sprayer, insect, hand, 2-gal.	23	7¾	7¾	.799	20	18	26½	26¼	10.57	168	6	
Sprayer, insect, pushcart-mtd, gasoline-driven, 30 GPH.	46	32	36	30.66	215	51	35	41	42.3	300	1	
Sprayer, insect, skid-mtd, gasoline-driven, 40 GPH.	----------	-------	--------	----------	----------	-------	-------	-------	45.0	575	1	
Spray outfit, paint, 2 gun w/compressor, wheelbarrow-mtd.	----------	-------	--------	----------	----------	[a] 53⅛	[a] 28	[a] 28¾	108.5	1,100	1	Dimensions are for tank group only.
Supplementary equipment, depot, packaging and preservation.	----------	-------	--------	583	7,818	-------	-------	-------	814.0	11,190	[b] ( )	
Tank, fabric, collapsible, nylon, 3,000-gal.	38	18	10	3.4	64	41½	19¼	11¼	5.070	75	1	
Toolkit, blacksmith's, gen.	----------	-------	--------	----------	----------	59	49	51	85.32	1,865	1	
Toolkit, carpenter's, engr squad, set No. 1.	34	17¾	8¼	2.893	80	36¾	19¼	9¾	3.982	124	1	
Toolkit, carpenter's, engr plat, set No. 2.	34	22	9	3.9	139	39	23¾	10¼	5.5	150	1	
Toolkit, carpenter's, set No. 3.	----------	-------	--------	----------	----------	-------	-------	-------	5.0	132	1	

Toolkit, pipefitter's, gen	25	14	9	1.8	114	28½	15¾	10⅛	2.63	125	1	
Toolkit, pipefitter's, supplemental.	61½	15	18	9.629	288.2	64½	16½	21¼	13.0	340	1	
Toolkit, precision instrument repair.	31	22	22	8.7	202	34	24	24	9.92	256	1	
Toolkit, sheet metal worker's, set No. 1.						26	20	16	4.81	152.9	8	
Tractor, full tracked, diesel, w/accessories.	215	90	111	1,243	19,180							
Water purification equipment set, portable, 900 GPH, set No. 2.									254.0	4,136	1	
Welding shop, trailer-mtd				420	4,900							
Ordnance												
Automobile, sedan, light	197	74	66	557	3,400							Dimensions and weight will vary with different models and manufacturers.
Carbine, M1	35.6			.5	5.6	41¾	18½	11¾	5.3	112.0	10	Uncrated weight without magazine.
Carbine, M2	35.6			.5	5.6	41¾	18½	11¾	5.3	112.0	10	Uncrated weight without magazine.
Demolition equipment set, explosive initiating, electric and nonelectric.				4.5	68							
Galvanometer, blasting, w/case and strap.	5½	4⅜	1⅜16	.022	1.25							
Gun, machine, cal 7.62-mm, M60.	43½				23.16							
Gun, machine, cal .50, hv barrel, M2.	[a] 65				82	69½	7¾	10⅛	3.2	117.0	1	Uncrated weight without tripod.
Gun, submachine, cal .45, M3.	22.8	2¾	7¾	.28	8.0	19¾	15¼	17	3.0	128.0	10	Uncrated length with stock closed. Uncrated weight without magazine.
Launcher, rocket, 3.5-in., M20A1B1.	60¼	8	13½	2.8	13	36½	33¼	16	11.2	150.00	4	
Machine, blasting, 100 cap capacity.	9	8⅜	18¼	.79	26.75							
Mount, tripod, machine gun, 7.62-mm, M122.	27	14			15							
Pistol, auto, cal .45	8⅝	1½	5½	.05	2.437	35⅜	10⅞	10⅝	2.4	105.0	25	
Rifle, cal .30, M1	43⅝				9.1	48½	19⅜	13⅞	7.5	164.0	10	
Rifle, 7.62-mm, M14	44.14				9.25							

See footnotes at end of table.

3.6. Weights and Dimensions of Organizational Equipment—Continued

Item	Uncrated					Crated						Remarks
	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)	Weight (lb)	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)	Weight (lb)	Number in container	
Semitrailer, low bed, 15-ton, 4-wheel, M172.	406	115	64	1,729	15,600							
Semitrailer, van, cargo, 6-ton, 2-wheel, M119A1.	275	93	104	[c] 2,076	7,180							
Shop set, field maint, autmv, fuel-electrical system, basic.	----	----	----	----	----	----	----	----	137.98	2,422	[b] ( )	
Shop set, field maint, machine, basic.	----	----	----	----	----	----	----	----	243.81	4,433	[b] ( )	
Shop set, field maint, machine, hv.	----	----	----	----	----	----	----	----	288.27	8,358	[b] ( )	
Shop set, field maint, machine, hv, No. 1, supplemental.	----	----	----	----	----	----	----	----	288.85	5,522	[b] ( )	
Toolkit, armorer's	----	----	----	1.11	57							
Toolkit, autmv, fuel-electrical system repairman.	----	----	----	.67	18							
Toolkit, electrician's, No. 1.	----	----	----	----	----	[a] 32	[a] 14½	[a] 15½	4	104	[b] ( )	
Toolkit, electrician's, No. 2.	----	----	----	.5	10							
Toolkit, gen mechanic's (Toolkit, autmv maint).	----	----	----	1.24	42.2							
Toolkit, org maint, No. 1, common.	----	----	----	----	----	----	----	----	84.0	1,662	[b] ( )	
Toolkit, org maint, No. 1, supplemental.	----	----	----	----	----	----	----	----	61.1	1,885	[b] ( )	
Toolkit, org maint, No. 2, supplemental.	----	----	----	131	3,076							
Toolkit, org maint, set No. 5, oxygen-acetylene.	----	----	----	----	----	----	----	----	5.38	305	[b] ( )	
Toolkit, org maint, set No. 7, hoist and towing.	----	----	----	----	----	----	----	----	120.0	1,005	[b] ( )	
Toolkit, welder's	----	----	----	1	31							
Trailer, amph, cargo, ¼-ton, 2-wheel, M100.	109	58	42	[c] 155.4	565							
Trailer, cargo, ¾-ton, 2-wheel, M101.	147	74	83	[c] 520	1,340							

Trailer, cargo, 1½-ton, 2-wheel, M105A2.	160	83	96	[c] 430	2,650						
Trailer, tank, water, 1½-ton, 2-wheel, 400 gal., M106.	167	93	80	[c] 700	2,280						
Truck, cargo, ¾-ton, 4 x 4, M37.	185	74	90	[c] 497	5,687						
Truck, cargo, ¾-ton, 4 x 4, M37, w/winch.	190	74	90	[c] 513	5,917						
Truck, cargo, 2½-ton, 6 x 6, M34.	262	88	105	[c] 1,094	11,775						
Truck, cargo, 2½-ton, 6 x 6, M34, w/winch.	276	88	105	[c] 1,150	12,190						
Truck, cargo, 2½-ton, 6 x 6, M35.	262	96	112	[c] 1,610	12,465						
Truck, cargo, 2½-ton, 6 x 6, M35, w/winch.	275	96	112	[c] 1,718	12,880						
Truck, cargo, 2½-ton, 6 x 6, M36.	323	93	125	[c] 2,240	13,500						
Truck, cargo, 2½-ton, 6 x 6, M36, w/winch.	336	93	125	[c] 2,320	13,915						
Truck, cargo, 2½-ton, 6 x 6, M135.	267	88	105	[c] 1,425	12,330						
Truck, cargo, 2½-ton, 6 x 6, M211, w/winch.	270	96	112	[c] 1,659	13,580						
Truck, tractor, 2½-ton, 6 x 6, M48.	253	94	100	[c] 1,366	11,840						
Truck, tractor, 5-ton, 6 x 6, M52, w/winch.	257	96	102	[c] 1,342	18,996						
Truck, utility, ¼-ton, 4 x 4, M38A1.	139	61	73	[c] 267	2,690						
Truck, utility, ¼-ton, 4 x 4, M151.	132	63	71	[c] 248	2,140						
Truck, van, shop, 2½-ton, 6 x 6, M109.	262	96	129	[c] 1,822	15,231						
Truck, van, shop, 2½-ton, 6 x 6, M220.	267	96	130	[c] 1,940	15,085						
Quartermaster											
Burner, oil stove, tent, M-1941.	----------	------	-------	2.29	55.4						
Cabinet, spare parts, 11-drawer, steel.	46¾	39	23 9/16	24.9	----------	------	------	------	14.33	197.0	1
Cabinet, storage assembly, tool.	46¾	38 13/16	23 9/16	24.9	----------	------	------	------	----------	400	1
Can, gasoline, 5-gal	13¾	6½	18⅜	.95	9.5						
Can, water, 5-gal	----------	------	-------	1.4	8						

See footnotes at end of table.

3.6. Weights and Dimensions of Organizational Equipment—Continued

Item	Uncrated					Crated						Remarks
	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)	Weight (lb)	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)	Weight (lb)	Number in container	
Container, food, insulated.	----------	------	-------	2.23	18.0							
Conveyor, gravity, roller, 45° curved section, 18 in. wide.	----------	22 23/32	7 1/4	4.05	87.0							
Conveyor, gravity, roller, 10-ft section, 18-in. wide.	120	21	4	5.23	156							
Crane, whs, mobile, gas, 10,000-lb capacity.	295	94	95	1,584	20,800							
Desk, field, empty, fiber composition.	----------	------	-------	2.7	39							
Desk, field, M–1945	----------	------	-------	4.3	68							
Desk, field, plywood	19 3/8	11 1/4	14 5/8	4.3	54							
Desk, field, plywood	22 5/8	25 7/8	14 1/2	4.9	----------	------	------	------	10.8	130	2	
Dispensing pump, hand-rotary, gasoline/kerosene, 12 GPM.	----------	------	96									
Heater, duct type, 250,000 BTU.	----------	------	-------	----------	----------	62.0	30.34	54.25	59.06	623	1	
Heater, immersion type, for cans, corrugated, liquid fuel fired 30 in.	----------	15 (diam)	30	5.5	68							
Heater, space, coal or oil, 45,000 BTU.	----------	18 5/8 (diam)	18 5/8	2.29	59.4	20.75	20.75	46.0	11.5	297	5	
Heater, tent, gasoline, 250,000 BTU.	----------	------	-------	57.9	596							
Heater, water, immersion, gas-operated, liquid fuel fired 37 1/4 in.	----------	13 1/2 (diam)	37 1/4	8.98	102							
Machine, sewing, hv duty, electric.	----------	------	-------	17.42	361.0							
Machine, shoe patch, electric.	----------	------	-------	11.14	217							
Outfit, officers' mess	----------	------	-------	2	45							
Paulin, duck, 17 x 12 ft	204	144	--------	[d] 2.3	57	------	------	------	----------	76	1	
Paulin, duck, 40 x 20 ft	480	240	--------	[d] 6.7	250	------	------	------	----------	332	1	
Pump, barrel, rotary, kerosene or gasoline, w/6-ft hose and nozzle.	----------	------	58	2.44	50							

Range outfit, field, gasoline, M–1937.									18.5	340	1
Safe, field, combination lock.				3	150						
Safe, keylock	17½	17	26	5.9	185						
Stove, gasoline burner, 5,500 BTU.			7.25						.09	21	1
Stove tent						20.75	20.75	46.0	11.5	297	5
Strapping kit, steel strapping, ¾-in. wide, 0.035-in. thick.				8.0	26						
Tank and pump, liquid dispensing, truck-mtd.						202	79	65	602.0	5,125	1
Tent, command post, complete w/pins and poles.	165	120	108	[d] 9.9	257						
Tent, gen purpose, medium, complete w/pins and poles.	396	192	120	[d] 19	455					605	1
Tent, kitchen, flyproof, complete w/pins and poles.	216	144	108	[d] 26	419				29	557	1
Tent, maint, complete w/pins and poles.	322	218	164	[d] 84.3	1,255				90	1,405	1
Tent, wall, large, complete w/pins and poles.	174	168	132	[d] 8.9	275				10	366	1
Tent, wall, small, complete w/pins and poles.	106	110	102	[d] 7.5	115					153	1
Tractor, whs, 4,000-lb, 144-in. lift.	116	66	62	277	5,800						
Trailer, whs, 4,000-lb	84	36	14	24.5	1,000						
Truck, fork, 4,000-lb. 144-in. lift.	119	79	106½	[a] 580	6,500						
Truck, hand, gen utility	56	24									
Truck, hand, 2-wheel, gen utility, curved U-type.	52	18		5.94	18						
Truck, lift, fork, gas, 6,000-lb, pneumatic tires, rough terrain.	204	86	91	868	17,000						
Typewriter, nonportable, 11-in. carriage.									4.13	76	1
Typewriter, nonportable, 18 to 19-in. carriage.									4.90	80	1
Typewriter, nonportable, 26 to 27-in. carriage.									8.39	125	1
Typewriter, portable, w/ carrying case.				1.5	35						

See footnotes at end of table.

3.6. Weights and Dimensions of Organizational Equipment—Continued

Item	Unerated					Crated						Remarks
	Length (In.)	Width (in.)	Height (in.)	Cubage (cu ft)	Weight (lb)	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)	Weight (lb)	Number in container	
Signal												
Anemometer, ML–497/-PM.	8	3½	2⅜	.03	1.00	16	14	17	2.20	142.0	100	
Axle, RL–27						24	1.75	1.75	.12	5.5	1	
Calibrating set, radiac, AN/UDM–1.				43.43	752				48.76	1,025		Packed in 4 boxes and 1 crate.
Calibrator, radiac, TS–784/PD.	10⅜	10⅛	5⅜	.5	6¾							
Camera, still picture, KS–4.	86¾	29⅜	62	91.5	147	90¾	30¾	36	58.2	272	2	
Charger, radiac detector, PP–354/PD.	45⅛	25	38¼	24.9	142	50½	30	42½	37.5	231	1	
Charger, radiac detector, PP–630/PD	6¾	2	5¼	.50	5							
Charger, radiac detector, PP/1578A/PD.	2⅝	1¼	2⁹/₁₆	.004	.5							
Multimeter, AN/URM–105.	6½	4⅛	3⁹/₃₂	.051								
Photographic equipment, PH–383.				10.0	333.0				34	505	1	
Printer, PH–129	27	18	51	14.3	80	42	29	23	16.2	185	1	
Radiacmeter, IM–9/PD	3⅝	7/16	7/16		.13							
Radiacmeter, IM–20/PD	4⅜	½	½		.09							
Radiacmeter, IM–93/UD	4 7/16	¾	⅝	.001	.13	18½	18½	16¾	4.00	200.00	1,200	
Radiacmeter, IM–147/-PD.	4¾	⅝	⅝		.13							
Radiacmeter, IM–174/-PD.	6¼	4⅛	4⅞	.072	3							
Radiac set, AN/MDQ–1	312	95	132	3,440								
Radiac set, AN/PDR–27	13⅛	10⅝	9⅝	.75	[e] 28							
Radiac set, AN/PDR–27E.	16 3/16	11½	9 21/32	1.02	[e] 28							
Radiac set, AN/PDR–27J.	17	5½	8½	.47	[e] 10.5							
Radiac set, AN/PDR–39	8	6.2	10.4	.298	11							
Radio set, AN/GRC–5	33⅝	13	14	3.54	[e] 189.5					[e] 252	1	
Radio set, AN/GRR–5	46¼	15¼	27¼	11.1	110	50	19	31	17	162	1	
Radio set, AN/PRC–6	15½	10¼	5½	.52	6	16½	11¼	6½	.66	7	1	
Radio set, AN/PRC–9	9½	3	10½	.17	26	10	12½	18¾	1.3	55	2	

Radio set, AN/PRC–10	9½	3	10½	.17	26	10	12½	18¾	1.3	55	2
Radio set, AN/VRC–9	18½	13	14	1.95	[e] 87					[a] 116	1
Radio set, AN/VRC–17	25¾	13	14	2.71	[e] 127					[a] 169	1
Radio set, AN/VRQ–2	37	13	14	3.9	[e] 200					[a] 267	1
Reel, cable, DR/8	9⅛	9	9	.43	2.50	44	40¾	38	4.92	45.00	12
Reel, unit, RL–31	38½	23	5½	5.00	80.00	39¾	32½	6½	6.73	124.00	1
Switchboard, manual, SB–22/PT.	12	12	16⅝	1.36	36.5					[a] 48.6	1
Switchboard, telephone, manual, SB–993/GT.	13	5	2	.08	4.50						
Telephone set, TA–312/–PT.	11½	2¼	7½	1.12	9.25						
Teletypewriter set, AN/–PGC–1.						30.88	25.88	22.38	10.34	150	1
Terminal, telegraph and telephone, AN/TCC–14.	15.8	11.5	25.75	2.68	70						
Test set, electron tube, TV–7/U.	15½	8¾	6¾	.50	46.00	22½	12⅝	11	1.70	60.00	1
Tool equipment, TE–33						8.38	3	1.75	.07	5.5	1
Wind measuring set, AN/GMQ–11:											
Box No. 1						39½	20¾	16⅝	8.80	91.00	
Box No. 2						9½	10½	78½	4.00	77.00	
Total				5.50	57.00				12.80	168.00	
Wire WD–1/TT on wire reel RL–159/UM1.	19¼ (diam)	17		2.00	70.00					[a] 93	1
Wire WD–1/TT in dispenser MX–306/G.	13½ (diam)	5½ (thick)	5½		27.00				3.50	130.00	4
Transportation											
Chain assembly, single leg, with pear links and 1 grab hook, ⅝ in. x 16 ft.	192 (min) 195 (max)								2.0	90	1
Tool set, org maint, set No. 4, block and tackle.				1.84	89.5						

[a] Approximate.
[b] One set packed in an unknown number of boxes.
[c] Shipping dimensions. Minimum dimensions to which a completely assembled vehicle may be reduced by lowering cab, top, or windshield, removing body bows, gun mounts, and so forth.
[d] Folded.
[e] With accessories in case.

3.7. Gasoline and Oil Supply Data for Chemical Units

Unit[a]	Fuel and lubricant requirements, motor vehicle consumption in moving unit 100 miles[b]				Gasoline capacity (gal.)			Fuel can data, number of organic 5-gal. fuel cans[c]			
	Vehicle fuel (gal.)	Engine oil (gal.)	Gear lubrication (lb)	Grease miscellaneous (lb)	Vehicle tanks	Total 5-gal. cans	Total vehicle tanks 5-gal. cans	Kitchens and miscellaneous	Motor vehicles	Total miscellaneous and motor vehicles	Organic kitchens[d]
Hq & hq det, cml gp	96.8	2.4	3.2	2.4	236	100	336	6	14	20	0
Hq & hq det, cml bn, svc	68.4	1.6	2.4	1.6	168	75	243	7	8	15	0
Hq & hq det, cml smoke genr bn	65.3	1.4	2.0	1.6	149	65	214	4	9	13	0
Cml combat spt co	907.4	18.0	30.8	20.4	2,114	970	3,084	80	114	194	1
(Combat spt plat)	(142.2)	(2.8)	(4.8)	(3.2)	(330)	(145)	(475)	(11)	(18)	(29)	0
Cml gen spt co	493.4	9.4	21.3	9.9	1,290	530	1,820	62	44	106	1
Cml maint co	255.1	5.0	9.4	5.4	613	250	863	21	29	50	1
Cml depot co	228.4	4.8	8.8	4.8	568	265	833	25	28	53	1
Cml depot co, COMMZ	284	5.4	9.9	6.1	742	295	1,037	21	38	59	1
Cml proc co	889.1	16.0	24.9	20.6	2,797	595	3,392	16	103	119	1
Cml lab	232.9	4.8	9.1	4.7	583	140	723	4	24	28	0
Cml decon co	476.4	9.4	17.1	10.3	990	310	1,300	18	44	62	1
Cml smoke genr co	541.9	12.4	18.7	12.7	1,315	1,110	2,425	157	65	[e]222	1

[a] Calculations include *nonorganic* transportation required to make units 100 percent mobile. See paragraph 3.5.

[b] These figures are based on highway operations with each vehicle carrying full loads of personnel and equipment. To plan for spillage, evaporation, and small losses, an additional 10 percent total consumption should be added. For cross-country movement, increase amount 2.5 times. (The 10 percent wastage factors need not be applied for cross-country movement.) Fuel consumption data for 2½-ton, 6 x 6 vehicles were calculated for the truck, 2½-ton, 6 x 6, M34.

[c] Amount includes gas cans for nonorganic transportation for 100 percent mobility. The amount includes cans authorized by TOE and TA 10–100.

[d] Average daily gasoline consumption (net) is 15 gallons per kitchen.

[e] This figure includes gas cans for basic load of gasoline (3 cans per generator) as fuel for smoke generator operation. The company also has a basic load of 192 drums (55 gal.) of fog oil (class III supplies) as fuel for smoke generator operation. The company is also authorized two 600-gal. liquid dispensing tank and pump units.

3.8. Gasoline and Oil Supply Data, Vehicles (Loaded)

Vehicle	Vehicle fuel tank capacity (gal.)	Fuel per 100 miles (gal.)	Oil per 100 miles (gal.)	Gear lubricant per 100 miles (lb)	Miscellaneous grease per 100 miles (lb)
Automobile, sedan, light	16	5.8	0.2	0.1	0.1
Decontaminating apparatus, power-driven, truck-mtd, M3A3[a]	50	20	.4	.8	.4
Truck, cargo, ¾-ton, 4 x 4,—	24	12	.2	.3	.3
Truck, cargo, 2½-ton, 6 x 6, M34	50	20	.4	.8	.4
Truck, cargo, 2½-ton, 6 x 6, M35	50	20	.4	.8	.4
Truck, cargo, 2½-ton, 6 x 6, M135	56	22.2	----------	----------	----------
Truck, cargo, 2½-ton, 6 x 6, M211	56	17.2	----------	----------	----------
Truck, shop van, 2½-ton, M109	50	20	.4	.8	.4
Truck, tractor, 2½-ton, M48	56	22.2	.4	.8	.4
Truck, tractor, 5-ton, M52	110	34	.6	.9	.8
Truck, utility, ¼-ton, 4 x 4,—	17	7.1	.2	.2	.2

[a] Mounted on M45 chassis.

3.9. Movement of Chemical Units by Rail

General information on planning factors for movement of units by rail is given in FM 101–10. Rail movement data may also be found in FM 9–2 and FM 55–15. Dimensions of individual vehicles can be found in TM 9–500. Before computing loading combinations, the computer should check with the transportation officer concerning Interstate Commerce Commission regulations, which vary with the individual type car. When units are to be moved in an oversea area, the computer should obtain from the transportation officer information as to the characteristics of rolling stock of foreign railroads. Spacing requirements for bracing and tying down equipment vary with different types of cars and must be allowed for in computation.

a. Movement of Cellular Unit. Requirements for movement of a cellular type chemical service unit (company, platoon, or detachment) organized with teams from the chemical service organization (TOE 3–500) depend upon the specific combination of teams which comprise the unit.

b. Movement of Organizational Equipment. Railway car requirements are computed on the basis of weights and cubages of crated equipment and on the number and dimensions of the vehicles, which are uncrated. Flat cars are utilized for the transport of vehicles and bulky equipment. A trailer and its prime mover are planned to be shipped together on the same flat car to facilitate loading and unloading. The maximum usable space in a 40-ton box car is considered to be 3,000 cubic feet. Supplies and basic loads are not included in the computation.

c. Movement of Chemical Unit Organizational Equipment by Rail.

Unit	TOE[a]	Organizational equipment (crated) less vehicles[b]		Railway cars required (all TOE equipment)		
		Weight (short tons)	Cubage[c] (cu ft)	Box or stock	40-ft flat	50-ft flat
Hq & hq det, cml gp	3–32E	5.9	557	0.19	5	0
Hq & hq det, cml bn, svc	3–36E	3.6	299	.10	3	0
Cml combat spt co	3–7D	42.5	3,990	1.33	55	4
(Combat spt plat)		(5.5)	(521)	(.17)	(10)	(0)
Cml gen spt co	3–147E	31.2	7,796	2.60	13	9
Cml maint co	3–47E	18.4	1,862	.62	11	0
Cml depot co	3–67D	71.3	905	.30	7	3
Cml proc co[d]	3–77E	128.0	9,517	.50	1	[e]8
Cml lab	3–97D	16.8	2,028	.68	3	0
Cml depot co, COMMZ	3–117E	24.1	1,663	.55	4	6
Cml decon co	3–217E	13.5	1,495	.59	19	1
Hq & hq det, cml smoke genr bn	3–266E	2.5	293	.10	5	0
Cml smoke genr co	3–267E	21.1	1,935	.64	28	2
Team AA, plat hq (full strength)	Negligible					
Team AB, plat hq (full strength)	3–500E	.8	63	.02	0	1
Team AC, co hq (full strength)	3–500E	1.0	76	.02	2	0
Team BA, supply (reduced strength)	3–500E	1.8	172	.06	2	0
Team BA, supply (full strength)	3–500E	1.7	278	.09	2	0
Team BB, supply (reduced strength)	3–500E	4.5	312	.10	1	1
Team BB, supply (full strength)	3–500E	10.5	1,155	.39	2	2
Team EA, maint (reduced strength)	3–500E	10.0	1,070	.36	2	0
Team EA, maint (full strength)	3–500E	10.0	1,230	.41	2	1
Team EB, maint (reduced strength)	3–500E	13.1	1,653	.55	4	0
Team EB, maint (full strength)	3–500E	17.5	2,085	.70	2	2
Team FA, decon (reduced strength)	3–500E	1.4	137	.05	1	1
Team FA, decon (full strength)	3–500E	2.0	174	.06	5	0
Team FB, decon (full strength)	3–500E	3.7	304	.10	10	0
Team GA, tech intel (full strength)	3–500E	1.2	127	.04	2	0
Team HA, mobile lab (full strength)	3–500E	3.5	388	.13	1	1
Team IA, munitions safety control (full strength)	3–500E	.6	45	.02	1	1
Team JA, CBR center (full strength)	3–500E	.6	45.3	.02	1	0

[a] This table does not include TOE changes published after 15 May 1962.

[b] Also less trailers and materials handling equipment.

[c] Radios, tools, and so forth, are assumed to be mounted on their vehicles.

[d] Includes two dryers authorized by MWO 3–409–45/1.

[e] Each processing plant requires three 50-ft flat cars and a fractional portion (0.3) of a 40-ft flat car (for the additional dryer). TM 3–409 states that a plant may be loaded in three freight cars (plus 0.3 car for the additional dryer).

d. Movement of Chemical Unit Personnel by Rail. The requirements for rail movement include individual equipment of personnel. Coach requirements are computed on the basis of 55 individuals per car. Pullman (standard or tourist) requirements are computed on the basis of two officers or three enlisted men per section. One kitchen-baggage car in which a portion of individual equipment may be loaded is allowed each unit.

Movement of Chemical Unit Personnel by Rail

Unit (TOE)[1]	Personnel	Coach	Pullman (standard or tourist) section[2]	Kitchen-baggage car
Hq & hq det, cml gp (3–32E)	50	0.91	19	1
Hq & hq det, cml bn, svc (3–36E)	31	.57	12	1
Cml combat spt co (3–7D)	246	4.50	84	1
(Combat spt plat)	(39)	(.71)	(14)	(1)
Cml gen spt co (3–147E)	131	2.38	45	1
Cml maint co (3–47E)	99	1.80	34	1
Cml depot co (3–67D)	144	2.70	49	1
Cml depot co, COMMZ (3–117E)	73	1.40	25	1
Cml proc co (3–77E)	93	1.70	32	1
Cml lab (3–97D)	52	.95	19	1
Cml decon co (3–217E)	115	2.10	39	1
Hq & hq det, cml smoke genr bn (3–266E)	22	.40	9	1
Cml smoke genr co (3–267E)	142	2.60	49	1
Admin and hq team AA (3–500E) (full strength)	2	.04	1	----
Admin and hq team AB (3–500E) (full strength)	4	.08	2	----
Admin and hq team AC (3–500E) (full strength)	6	.11	3	----
Supply team BA (3–500E) (reduced strength)	12	.22	4	----
Supply team BA (3–500E) (full strength)	18	.33	7	----
Supply team BB (3–500E) (reduced strength)	27	.49	10	----
Supply team BB (3–500E) (full strength)	37	.67	13	----
Maint team EA (3–500E) (reduced strength)	17	.31	6	----
Maint team EA (3–500E) (full strength)	20	.36	7	----
Maint team EB (3–500E) (reduced strength)	32	.58	12	----
Maint team EB (3–500E) (full strength)	49	.89	17	----
Decon team FA (3–500E) (reduced strength)	8	.15	3	----
Decon team FA (3–500E) (full strength)	22	.40	8	----
Decon team FB (3–500E) (full strength)	41	.75	14	----
Tech intel team GA (3–500E) (full strength)	10	.18	4	----
Mobile lab team HA (3–500E) (full strength)	20	.36	8	----
Munitions safety control team IA (3–500E) (full strength)	20	.36	8	----
CBR center team JA (3–500E) (full strength)	5	.09	2	----

[1] This table does not include TOE changes published after 15 May 1962.

[2] Tourist pullman: number of sections 13 to 60, depending on type. Standard pullman: 12 sections and drawing room, or 16 sections and no drawing room.

3.10. Air Transportation

A general description of the various types of mobilization aircraft (Army and Air Force) and their technical characteristics and performance data are contained in TM 57–210. For considerations governing the employment of air transportation, see FM 100–5. For staff procedures, air movement tables, and other forms relative to air movements, see FM 7–100, FM 57–100, and TM 57–210. FM 101–10, part I, contains a discussion on the air movement of supplies.

a. Army Aircraft. Army aircraft, both fixed-wing and rotary-wing, are employed to move cargo, personnel, and equipment within the combat zone. Since performance standards are affected by many variables, the Army aviation staff officer should be consulted for accurate,

detailed computations to meet specific requirements. Army aircraft characteristics, aircraft planning factors, and the methods for determining Army aircraft requirements are contained in FM 101–10, part I.

b. Air Force Transport Aircraft. For general considerations and procedures governing the employment of Air Force transport aircraft in joint operations, see FM's 100–5; 101–5; 57–10; 57–100; and 101–10, parts I and III.

c. Aircraft Requirements.

(1) Aircraft requirements listed in *d* below reflect the number of sorties required to transport the various units. Aircraft requirements are based on the following assumed allowable cargo loads:

Type aircraft	*Allowable cargo load (lb)*
C–130, medium transport airplane	[a] 29,500
C–124, heavy transport airplane	[b] 55,000
C–133, heavy transport airplane	[b] 95,418

[a] 1,000-nautical mile radius. If aircraft can be refueled at destination, the weight can be increased (see TM 57–210).
[b] 1,000-nautical mile range.

(2) In determining aircraft requirements, the "weight method" (as opposed to the "type load method") (see TM 57–210) has been utilized. Units have been loaded administratively rather than tactically. The aircraft requirements are based on the entire unit being transported in each type of aircraft.

(3) Unless otherwise indicated, all units are moved at 100 percent personnel and equipment TOE strength. The gross weight (short tons) of a unit is the sum of the combined weights of personnel, organizational equipment (uncrated), class I supplies for 3 days, class III supplies for 300 miles, and a basic load of class V supplies. The basic load of chemical nontoxic ammunition (SB 3–39) is not included in the computations. Prescribed loads of repair parts, depot stocks, and other prescribed loads of supplies other than fog oil for smoke units are also not included in the computations. An average weight of 240 pounds was assumed for each man. Class I supply is based on 3 days of supply to accompany each unit, with an average of 6.6 pounds per man per day. Class III supplies are based upon the weight of gasoline, oil, and lubricants required to operate vehicles a minimum of 300 miles. Class V supply weights for service units are based on a basic load for a unit with the mission of providing normal security.

d. Movement of Chemical Units by Air. This listing does not include TOE changes published after 15 May 1962.

Unit	TOE	Weight of equipment (unerated) (short tons)	Weight of personnel and supplies (short tons)	Gross weight (short tons)	Aircraft requirements		
					C–130 only	C–124 only	C–133 only
Hq & hq det, cml gp	3–32E	26.1	7.9	34.0	3	2	1
Hq & hq det, cml bn, svc	3–36E	17.1	4.7	21.8	2	1	1
Cml combat spt co	3–7D	343.9	45.0	388.9	27	15	9
(Combat spt plat)		(53.6)	(7.2)	(60.8)	(5)	(3)	(2)
Cml gen spt co	3–147E	242.7	21.8	264.5	[a b c] 16	10	6
Cml maint co	3–47E	94.3	15.5	109.8	[a] 7	4	3
Cml depot co	3–67D	109.1	20.9	130.0	[d] 7	5	3
Cml depot co, COMMZ	3–117E	129.2	11.6	140.8	[e] 10	5	3
Cml decon co	3–217E	166.3	19.8	186.1	13	7	4
Hq & hq det, cml smoke genr bn	3–266E	20.6	3.6	24.2	2	1	1
Cml smoke genr co	3–267E	190.3	[f] 79.7	270.0	19	10	6
Team AA, plat hq (full strength)	3–500E	Negligible					

See footnotes at end of table.

d. Movement of Chemical Units by Air—Continued

Unit	TOE	Weight of equipment (uncrated) (short tons)	Weight of personnel and supplies (short tons)	Gross weight (short tons)	Aircraft requirements		
					C-130 only	C-124 only	C-133 only
Team AB, plat hq (full strength)	3-500E	11.6	0.8	12.4	1	[g] ( )	[g] ( )
Team AC, co hq (full strength)	3-500E	13.1	1.3	14.4	1	[g] ( )	[g] ( )
Team BA, supply (reduced strength)	3-500E	12.9	2.2	15.1	1	1	[g] ( )
Team BA, supply (full strength)	3-500E	21.8	3.0	24.9	[b] 1	1	[g] ( )
Team BB, supply (reduced strength)	3-500E	28.5	4.3	32.8	[b] 2	2	1
Team BB, supply (full strength)	3-500E	49.9	6.2	56.1	[b] 3	2	2
Team EA, maint (reduced strength)	3-500E	26.6	2.9	29.5	[b] 2	2	1
Team EA, maint (full strength)	3-500E	29.5	3.5	33.0	[b] 2	2	1
Team EB, maint (reduced strength)	3-500E	42.8	5.7	48.5	[b] 3	2	1
Team EB, maint (full strength)	3-500E	54.4	8.0	62.4	[a] 3	3	2
Team FA, decon (reduced strength)	3-500E	19.0	1.7	20.7	2	1	[g] ( )
Team FA, decon (full strength)	3-500E	52.5	4.6	57.1	4	3	2
Team FB, decon (full strength)	3-500E	87.3	8.7	96.0	7	4	3
Team GA, tech intel (full strength)	3-500E	13.8	2.0	15.8	2	2	[g] ( )
Team HA, mobile lab (full strength)	3-500E	15.8	3.3	19.1	2	1	[g] ( )
Team IA, munitions safety control (full strength)	3-500E	18.3	1.8	20.1	[i] 1	1	[g] ( )
Team JA, CBR center (full strength)	3-500E	3.9	.8	4.7	[g] ( )	[g] ( )	[g] ( )

[a] Does not include two trucks, shop van, 2½-ton.
[b] Does not include No. 6,000 fork lift.
[c] Does not include one 10,000-lb mobile crane.
[d] Does not include three 3-ton crane-shovels, truck-mounted.
[e] Does not include two 10,000-lb mobile cranes and one 20-ton crane-shovel.
[f] Includes 52.7 tons of fog oil (basic load).
[g] Not enough weight to make efficient use of these aircraft.
[h] Does not include one truck, shop van, 2½-ton.
[i] Does not include one 6-ton semi-van and tractor.

3.11. Water Movement

Amphibious force planning factors and characteristics of amphibious force vessels and craft are contained in FM 101–10. Capacities and characteristics of ocean-going vessels are also contained in FM 101–10. The following data (measurement tons) can be used in calculating vessel requirements.

Movement of Chemical Units by Water

Unit	TOE [1]	Weight of organizational equipment (short tons) [2]	Cubage (measurement tons) [3]	Unit	TOE [1]	Weight of organizational equipment (short tons) [2]	Cubage (measurement tons) [3]
Hq & hq det, cml gp	3–32E	28.1	148.7	Team BB (supply) (full strength)	3–500E	51.9	317.2
Hq & hq det, cml bn, svc	3–36E	18.4	100.8	Team EA (maint) (reduced strength)	3–500E	27.3	149.6
Cml combat spt co	3–7D	350.7	2,628.7	Team EA (maint) (full strength)	3–500E	30.2	166.2
(Combat spt plat)		(54.7)	(373.3)	Team EB (maint) (reduced strength)	3–500E	44.2	255.8
Cml gen spt co	3–147E	248.5	1,439	Team EB (maint) (full strength)	3–500E	56.2	312.1
Cml maint co	3–47E	97.6	559.2	Team FA (decon) (reduced strength)	3–500E	19.5	114.7
Cml depot co	3–67D	124.6	547.4	Team FA (decon) (full strength)	3–500E	53.2	320.1
Cml proc co [4]	3–77E	148.0	365.4	Team FB (decon) (full strength)	3–500E	88.6	618.3
Cml lab	3–97D	26.0	111.4	Team GA (tech intel) (full strength)	3–500E	14.1	101.6
Cml depot co, COMMZ	3–117E	133.5	629.1	Team HA (mobile lab) (full strength)	3–500E	16.1	99.4
Cml decon co	3–217E	170.3	941.1	Team IA (munitions safety control) (full strength)	3–500E	18.6	162.7
Hq & hq det, cml smoke genr bn	3–266E	21.2	155.8	Team JA (CBR team) (full strength)	3–500E	4.1	26.6
Cml smoke genr co	3–267E	195.2	1,141.8				
Team AA (plat hq) (full strength)	3–500E	Negligible					
Team AB (plat hq) (full strength)	3–500E	12.1	61.6				
Team AC (co hq) (full strength)	3–500E	13.9	72.3				
Team BA (supply) (reduced strength)	3–500E	13.5	137.6				
Team BA (supply) (full strength)	3–500E	22.7	160.7				
Team BB (supply) (reduced strength)	3–500E	29.5	162.8				

[1] This table does not include TOE changes published after 15 May 1962.

[2] All items except vehicles with tools and radios, trailers, and materials handling equipment are crated.

[3] Measurement ton = 40 cubic feet (ship ton).

[4] Includes two dryers authorized by MWO 3–409–45/1.

Section III. CHEMICAL TRAINING

3.12. References

Training publications are listed in DA Pam 310–3. For information pertaining to tables of allowances for training, see DA Pam 310–7. Information pertaining to chemical, biological, and nuclear training exercises and integrated training is given in FM 21–48. Small unit procedures in CBR operations are outlined in detail in FM 21–40.

3.13. Training of Individuals

ATP 21–114 allots 8 hours to chemical and biological operations and nuclear warfare training during the basic combat training phase. This training is outlined in ASubjScd 21–6. Standards of proficiency for individuals and units are given in FM 21–40.

3.14. Training of Units

Units below division level must have selected personnel receive specialized training to assist the commander in fulfilling his responsibilities in CBR operations. All units of the Army are trained in defense against CBR attack in accordance with FM 21–40 and other pertinent publications.

3.15. CBR Proficiency Testing

Training tests involving chemical and biological operations and nuclear warfare must be designed to require prompt and correct decisions, proper sequence of actions, and, above all, emphasis on continuing the mission. Information on the techniques of testing is given in FM 21–6 and FM 21–48.

Section IV. CHARACTERISTICS OF CHEMICAL AGENTS, CHEMICAL-FILLED MUNITIONS, AND CHEMICAL EQUIPMENT

3.16. Characteristics of Chemical Agents

Name and symbol	Odor	Use and physiological classifications	State at 20° C.	Effect on body
Distilled mustard, HD.[1]	Like garlic or horseradish.	Casualty agent. Blister agent.	Colorless to pale yellow liquid.	Injures eyes and lungs; blisters skin.
Mustard, H.[1]	Like garlic or horseradish.	Casualty agent. Blister agent.	Dark liquid.	Injures eyes and lungs; blisters skin.
Nitrogen mustard, HN1.[1]	Odorless to faint fishy.	Casualty agent. Blister agent.	Dark liquid.	Injures eyes and lungs; blisters skin.
Mustard T-mixture, HT.[1 2]	Like garlic or horseradish.	Casualty agent. Blister agent.	Clear to pale yellow liquid.	Injures eyes and lungs; blisters skin.
Lewisite, L.[1]	Irritating, unpleasant; faintly like geraniums.	Casualty agent. Blister agent.	Dark, oily liquid.	Injures eyes and blisters skin. Arsenic poisoning.
GA.[1]	Faintly fruity, sweetish (odor because of impurities).	Casualty agent (fast acting). Nerve agent.	Colorless to brown liquid.	Causes blurred vision with pinpointing of pupils, skin and eye spasms, difficult breathing, tight chest, salivation, mental confusion, convulsions.
GB.[1]	Odor scarcely detectable; none when pure.	Casualty agent (fast acting). Nerve agent.	Colorless liquid.	Causes blurred vision with pinpointing of pupils, skin and eye spasms, difficult breathing, tight chest, salivation, mental confusion, convulsions.
VX.	Odorless.	Casualty agent. Nerve agent.	Colorless liquid.	Similar to effects from GB.
Hydrocyanic acid (hydrogen cyanide), AC.	Like peach kernels.	Casualty agent (fast acting). Blood agent.	Colorless liquid.	Causes dizziness, convulsions, paralysis, coma, collapse.

See footnotes at end of table.

Persistency effect	Possible dispersion methods	Stability in storage	Temperature effects	Munitions used in—
Summer: 3 or 4 days in open; 1 week in woods. Winter: several weeks.	Artillery, bomb, landmine, mortar, rocket, spray.	Very stable.	Freezes at 14.4°C. Boils at 227.8° C.	Bombs: M70A1. 1-gal. landmine. 4.2-in. mortar cartridge: M2, M2A1. 105-mm how. cartridge: M60. 155-mm how. projectile: M110. 155-mm gun projectile: M104. Aircraft smoke tank: M10.
Summer: 3 or 4 days in open; 1 week in woods. Winter: several weeks.	Artillery, bomb, landmine, mortar, rocket, spray.	Decomposes because of impurities; produces pressure.	Freezes at approx. 8.89° C. Boils above 204° C.	Bombs: M70. 1-gal. landmine. 4.2-in. mortar cartridge: M2. 155-mm how. projectile: M110. Aircraft smoke tank: M10.
Summer: 3 or 4 days in open; 1 week in woods. Winter: several weeks.	Artillery, bomb, landmine mortar, rocket, spray.	Adequate.	Freezes at – 34.2° C. Boils at 85° C. and 10 mm Hg.	
Summer: more persistent than HD or H. Winter: more persistent than HD or H.	Artillery, bomb, landmine, mortar, rocket, spray.	Stable in steel and glass.	Freezes at approx. 1.1° C. Boils above 228° C.	4.2-in. mortar cartridge: M2.
Summer: 1 day in open; 2 or 3 days in woods. Winter: 1 week or longer.	Artillery, bomb, landmine, mortar, rocket, spray.	Stable.	Freezes at – 18.2° C. Boils at 190° C.	
Summer: 10 minutes–24 hours. Winter: 10 minutes–24 hours.	Artillery, bomb, landmine, mortar, rocket, spray.	Stable in steel.	Freezes at – 48.9° to – 50° C. Boils at 246° C.	
Summer: 10 minutes–12 hours. Winter: 10 minutes–12 hours.	Artillery, bomb, landmine, mortar, rocket, spray.	Stable when pure.	Freezes at – 56° C. Boils at 147° C.	Rocket: M55. Landmine: ABC–M23. Bomb: MC–1, M125, M125A1. 105-mm how. cartridge: M360. 155-mm how. projectile: M121, M121A1. 155-mm gun projectile: M122. 8-in. how. projectile: M426. 762-mm rocket: M79.
----------	Rockets, mines, artillery, mortars.	----------	----------	Rocket: M55. Landmine: ABC–M23. 155-mm how. projectile: M121A1. 8-in. how. projectile: M426.
Summer: 1–10 minutes. Winter: several hours.	----------	Stable if pure or stabilized, often burns on shellburst.	Freezes at – 13.9° C. Boils at 25.7° C.	

3.16. Characteristics of Chemical Agents—Continued

Name and symbol	Odor	Use and physiological classifications	State at 20° C.	Effect on body
Cyanogen chloride, CK.[3]	Somewhat like AC, but irritating.	Casualty agent (fast acting). Blood agent.	Colorless gas.	Injures lungs; causes convulsions, paralysis, respiratory arrest.
Phosgene, CG.[3]	Like new mown hay or green corn.	Casualty agent (delayed action). Choking agent.	Colorless gas.	Injures lungs, causing accumulation of fluid.
Chloroacetophenone, CN.[3]	Fragrant.	Riot control agent. Tear agent.	Solid.	Causes tears and irritates skin; no permanent injury.
Chloroacetophenone solution, CNB.[3]	Like benzene.	Riot control agent. Tear agent.	Liquid.	Causes tears and irritates skin.
Chloroacetophenone solution, CNC.[3]	Like chloroform.	Riot control agent. Tear agent.	Liquid.	Causes tears and irritates skin.
Chloroacetophenone solution, CNS.[3]	Like flypaper.	Riot control agent. Tear agent.	Liquid.	Causes violent tears and irritates skin, acts as vomiting and choking agent also.
Adamsite, DM.[2 3 4]	Odorless.	Riot control agent. Vomiting agent	Yellow to green solid.	Headache, nausea, violent sneezing, temporary mental depression.
O-chlorobenzal-malononitrile, CS.	Like pepper.	Riot control agent. Tear agent.	White to cream solid.	Causes tears, irritates skin, and acts as a vomiting agent. May cause temporary pain in the chest.
Diphenylchloroarsine, DA.[2 3]	Odorless.	Riot control agent. Vomiting agent.	White to brown solid.	Causes headache, nausea, vomiting, sneezing.

See footnotes at end of table.

Persistency effect	Possible dispersion methods	Stability in storage	Temperature effects	Munitions used in—
5–10 minutes	Artillery, bomb, mortar, rocket.	Unstable; tends to polymerize, sometimes with explosive violence.	Freezes at – 6.7 to – 5° C. Boils at 13° C.	Bombs: AN–M78, AN–M79. 4.2-in. mortar cartridge: M2, M2A1.
Summer: 5 minutes in open; 10 minutes in woods. Winter: 10 minutes in open; 20 minutes in woods.	Artillery, bomb, mortar, rocket.	Stable in steel if CG is dry	Freezes at – 127.5° C. Boils at 7.48° C.	Bombs: AN–M78, AN–M79. 4.2-in. mortar cartridge: M2.
Summer: 1–10 minutes. Winter: 1–10 minutes.	Candle, capsule, grenade, mortar, pellet, mechanical disperser.	Stable	Freezes at 54-55°C. Boils at 244–245° C.	Grenades: M6A1, M7, M7A1, M25A1, M25A2. Capsule: CN. Riot control agent dispersers (CN1). Pellet: M2.
Summer: 1–10 minutes. Winter: 1–10 minutes.	Artillery, bomb, grenade, mortar, spray.	Adequate	Freezes at – 7° to – 30° C. Boils from 75° to 247° C.	Aircraft smoke tank: M10.
Summer: 1–10 minutes. Winter: 1–10 minutes.	Artillery, bomb, grenade, mortar, spray.	Adequate	Freezes at approx 0° C. Boils from 60° to 247° C.	Aircraft smoke tank: M10.
Summer: 1 minute–1 hour. Winter: 1 minute–1 hour.	Artillery, bomb, grenade, mortar, spray.	Adequate	Freezes at approx 1.7° C. Boils from 60° to 247° C.	
Summer: 1–10 minutes. Winter: 1–10 minutes.	Candle, grenade, mechanical disperser.	Stable in steel or glass.	Freezes at 195° C. Boils at 410° C.	Grenade: M6, M6A1. Riot control agent dispersers (DM1).
----------	Candle, grenade, mechanical disperser.	Stable	Freezes at 93° to 95° C. Boils at 310° to 315° C.	Grenades: M7A1, M7A2, M25A2 Riot control agent dispersers (CS1).
Summer: 1–10 minutes. Winter: 1–10 minutes.	Candle, grenade.	Stable when pure.	Freezes at 43.89° C. Boils at 307.2° C.	

3.16. Characteristics of Chemical Agents—Continued

Name and symbol	Odor	Use and physiological classifications	State at 20° C.	Effect on body
Hexachloroethane-zinc oxide mixture, HC.[5]	Slightly acrid.	Screening smoke.	Solid.	30-minute exposure to ordinary concentration harmless; 1-hour exposure to heavy concentration may irritate nose and throat and cause illness. Heavy metal poisoning possible with prolonged exposure.
Titanium tetrachloride, FM.[5]	Acrid or pungent.	Screening smoke.	Colorless liquid.	Smoke slightly irritates nose and throat; spray droplets or liquid injures eyes; liquid burns skin.
Sulfur trioxide in chlorosulfonic acid, FS.[5]	Acrid.	Screening smoke.	Liquid.	Smoke not toxic in ordinary concentration; high concentration irritates eyes, throat, and chest and may cause illness; liquid is corrosive and burns skin.
Fog oil SGF2.[6]	Like petroleum oil.	Screening smoke.	Liquid.	Prolonged exposure can irritate lungs and throat.
White phosphorus, WP.[7]	Like burning matches.	Screening smoke.	Pale yellow, translucent solid.	Smoke is harmless; solid particles burn flesh.

See footnotes at end of table.

Persistency effect	Possible dispersion methods	Stability in storage	Temperature effects	Munitions used in—
Subject to atmospheric conditions.	Artillery, bomb, grenade, mortar, pot, rocket.	Stable in steel drums; is fire hazard with moisture.	None for mixture.	Grenade: AN–M8. 105-mm how. cartridge: M84. 155-mm how. projectile: M116B1. Smoke pot: M4A2, M5.
Subject to atmospheric conditions.	Artillery, mortar, spray.	Stable in absence of moisture.	Freezes at – 30° C. Boils at 135° C.	4.2-in. mortar cartridge: M2. Aircraft smoke tank: M10.
Evaporates immediately; subject to atmospheric conditions.	Artillery, mortar, rocket, spray.	Stable in absence of moisture	Freezes below – 30° C. Decomposes at 80° C.	Aircraft smoke tank: M10.
Subject to atmospheric conditions.	Smoke generator, grenade, pots.	Very stable...	Pours at – 40° C. Ignites at about 207° C.	Smoke generator: M3A3. Smoke candle: M6. Smoke pots: AN–M7, MK 5.
Subject to atmospheric conditions.	Artillery, bomb, grenade, mortar, rocket.	Stable in steel drums when not contacted by oxygen or air.	Freezes at 44° C. Boils at 290° C.	Bombs: M47A3. Hand grenade: M15, M34. Rifle grenade: M19A1. Igniter: M16. 3.5-in. rocket: M30. 4.2-in. mortar cartridge: M2, M2A1, M328, M328B1. 4.5-in. rocket: MK 10. 5-in. projectile: MK 30, MK 48. 5-in. rocket: MK 30. 6-in. projectile: MK 41. 57-mm rifle cartridge: M308A1. 60-mm mortar cartridge: M302. 75-mm rifle cartridge: M311. 81-mm mortar cartridge: M57A1. M370. 90-mm gun cartridge: M313, M313C. 105-mm how. cartridge: M60. 155-mm how. projectile: M110, M105. 155-mm gun projectile: M104. 76-mm cartridge: M361. 120-mm projectile: M357.

3.16. Characteristics of Chemical Agents—Continued

Name and symbol	Odor	Use and physiological classifications	State at 20° C.	Effect on body
Plasticized white phosphorus, PWP.	Like burning matches.	Screening smoke.	Finely divided WP in gel of rubber and xylene.	Same effect on body as WP.
Green smoke, GS.	Acrid.	Signaling smoke.		
Red smoke, RS.	Acrid.	Signaling smoke.		
Violet smoke, VS.	Acrid.	Signaling smoke.		
Yellow smoke, YS.	Acrid.	Signaling smoke.		
Incendiary mixture, PT1.[8]	Like petroleum oil.	Incendiary.	Soft, black, elastic, homogeneous mixture.	Can cause severe burns when ignited.
Incendiary oil (isobutyl methacrylate), IM.[9]	Like gasoline.	Incendiary.	Gel.	Can cause severe burns when ignited.
Incendiary oil, NP.[10]	Like petroleum oil.	Incendiary.	Gel.	Can cause severe burns when ignited.
Incendiary oil, NP2.[11]	Like petroleum oil.	Incendiary.	Gel.	Can cause severe burns when ignited.
Incendiary oil, NP3.[12]	Like kerosene.	Incendiary.	Liquid.	Can cause severe burns when ignited.
Thermite, TH1.	None.	Incendiary.	Grayish solid.	Can cause severe burns when ignited.
Thermate, TH3.	None.	Incendiary.	Grayish solid.	Can cause severe burns when ignited.
Thermate, TH4.	None.	Incendiary.	Grayish solid.	Can cause severe burns when ignited.

[1] Requires protective clothing and mask.
[2] Decomposes below boiling point at normal atmospheric pressure.
[3] Requires protective mask.
[4] This material contains arsenic; therefore, it should not be used in inclosed spaces.
[5] Mask required in dense concentrations.
[6] Used when air temperature is between —18° and 5° C.
[7] Secondary tactical classification is an antipersonnel agent; agent also has some incendiary effect.
[8] PT1 is composed of petroleum oil, magnesium waste, and isobutyl-methacrylate polymer as thickener.
[9] Incendiary oil, IM, is composed largely of isobutyl-methacrylate and gasoline.
[10] NP is composed of petroleum oil and napalm (M1 thickener).
[11] NP2 is composed of petroleum oil and antiagglomerated napalm (M2 thickener).
[12] NP3 is composed of kerosene and napalm.

Persistency effect	Possible dispersion methods	Stability in storage	Temperature effects	Munitions used in—
2–3 minutes	Artillery, bomb, grenade, mortar, rocket.	Stable in steel when not contacted by oxygen or air.	Freezes at 43.9° C. Boils at 290° C.	Bombs: AN–M47A3, AN–M47A4. 5-in. rocket: MK 4. 4.2-in. mortar cartridge: M2.
Subject to atmospheric conditions.	Artillery, bomb, grenade.			Rifle grenade: M22A2. Hand grenade: M18. 105-mm how. cartridge: M84. 155-mm how. projectile: M116B1. Ground signal: M128E1. Streamer: M23.
Subject to atmospheric conditions.	Artillery, bomb, grenade.			Rifle grenade: M22A2. Hand grenade: M18. 105-mm how. cartridge: M84. 155-mm how. projectile: M116B1. Ground signal: M129E1. Streamer: M23.
Subject to atmospheric conditions.	Artillery, bomb, grenade.			Rifle grenade: M22A2. Hand grenade: M18. 105-mm how. cartridge: M84. 155-mm how. projectile: M116. Streamer: M23.
Subject to atmospheric conditions.	Artillery, bomb, grenade.			Rifle grenade: M22A2. Hand grenade: M18. 105-mm how. cartridge: M84. 155-mm how. projectile: M116B1. Streamer: M23.
None.	Bomb.	Stable but flammable.		Bombs: AN–M47A4, M74, M74A1.
None.	Bomb.	Stable but flammable.		
None.	Bomb, flamethrower.	Stable but flammable.		Portable flamethrower. Mecbanized flamethrower. Fire bombs: M116A1, M116A2. Flame field expedients.
None.	Bomb	Stable but flammable.		Fire bombs: M116A1, M116A2. Flame field expedients.
None.	Fire starter	Stable but flammable.		Fire starter.
None.	Equipment and safe-destroying incendiary.	Stable but flammable.		Cryptographic equipment destroyer: M1A1, M1A2, M2A1.
None.	Bomb, grenade.	Stable but flammable.		Bombs: AN–M50A3, M126. Grenade: AN—M14.
None.	Equipment and safe-destroying incendiary.	Stable but flammable.		Cryptographic equipment destroyer: M2A1.

3.17. Characteristics of Chemical-Filled Munitions

Characteristics of chemical-filled munitions are shown in *h* through *j* below.

a. General. The Chemical Corps stores and issues class V chemical-filled munitions, except artillery projectiles, mortar cartridges, rifle grenades, and smoke rockets which, after being filled by the Chemical Corps, are stored and issued by the Ordnance Corps.

b. Standard Color Coding System. Most chemical munitions presently being manufactured are marked in accordance with Military Standard 709, 27 June 1960.

(1) *Chemical agents.* Chemical agents to include toxic chemical agents (casualty agents) and irritant agents (riot control agents) are indicated by a gray background with appropriate bands to indicate the filling. The presence of a high or low explosive charge is indicated by a yellow or brown band, respectively.*

(*a*) *Toxic chemical agents.* Gray background with green bands; one band for nonpersistent effect agents, two for persistent effect agents, and three for nerve agents.

(*b*) *Irritant agents.* Gray background with red bands; one band for nonpersistent effect agents, two for persistent effect agents.

(2) *Incendiaries.* Light red background with all lettering in black.

(3) *Smoke.* Light green background. White phosphorus (WP) will be lettered in light red to indicate its incendiary nature for safety, storage, and handling purposes. Other smoke munitions will be lettered in black or white. The Chemical Corps is presently lettering smoke munitions in black. The black lettering is a departure from Military Standard 709, 27 June 1960, which specifies white lettering. At the date of this publication, a change to Military Standard 709 has been proposed to reflect this departure. Users of this manual are cautioned to check the latest changes to Military Standard 709.

(4) *Practice.* Blue background with all lettering in black. The presence of a high or low explosive charge is indicated by a yellow or brown band, respectively.

c. Previous Marking System. All chemical munitions manufactured before January 1961 follow the five-element marking system. According to this system all chemical, incendiary, and smoke munitions are marked with a gray background. One band around the munition indicates a nonpersistent effect agent, and two bands indicate a persistent effect agent. Green markings on the gray background signify toxic chemical agents; red markings—irritant agents; purple—incendiaries; and yellow—smokes. A descriptive word such as gas, smoke, or incendiary indicates the general nature of the agent. A chemical agent symbol (GB, VX, HD) indicates the exact filling. For additional information on chemical munitions, see TM's 3–300, 3–400, 9–1901–1, 9–1300–203, 9–1300–204, and 9–1300–205.

d. Application. All chemical munitions manufactured prior to January 1961 will retain their original color code markings. The old five-element marking system and the new standard color coding system (Mil Std 709) are described in *h* through *j* below.

e. Storage Group Classification. To simplify problems of safety and firefighting, chemical munitions have been divided, for storage purposes, into four groups according to the nature of the chemical agents, as follows:

Group A—chemical agents against which complete protective clothing and protective mask are required (HD, VX, GB).

Group B—those agents requiring the protective mask alone (CG, CK, C1); nonburning screening smokes (FS, FM); nonburning mixtures of irritant agents (CN1, DM1, CS1, CNC, CNB).

Group C—spontaneously flammable chemical agents (WP, PWP).

Group D—incendiary and readily flammable chemical agents (TH3, PT1).

f. Explosive and Nonexplosive Types. Munitions for which entries are made in the burning time column of the table are burning (nonexplosive) type. Those for which entries are made in the radius of burst column are bursting (explosive) type.

g. References. Field manuals, technical manuals, technical bulletins, and other publications which give detailed information about chemical-filled munitions are listed in the remarks column of the table.

*Except for rocket motors which are identified with a brown band, chemical-filled ammunition which is stored and issued by the Ordnance Corps is not marked with the yellow or brown band.

FIVE-ELEMENT MARKING SYSTEM (OLD)

BACKGROUND COLOR (CML MUNITION)	NO. OF BANDS (DURATION OF EFFECTIVENESS)	COLOR OF MARKINGS (USE)	SYMBOL (EXACT FILLING)	DESCRIPTIVE WORD (GENERAL NATURE OF AGENT ON RELEASE)
	[redacted]	TOXIC CHEMICAL AGENTS (CASUALTY AGENTS)	GB, CG, CK	GAS
	[redacted]	TOXIC CHEMICAL AGENTS (CASUALTY AGENTS)	VX, HD, H, HT	GAS
	[redacted]	IRRITANT AGENTS (RIOT CONTROL AGENTS)	CN, DM, CS, CN1, DM1, CS1	GAS
	[redacted]	INCENDIARIES	TH, NP, PT1, PTV	INCENDIARY
				SMOKE

STANDARD COLOR CODING SYSTEM (NEW)[1]

TOXIC CHEMICAL AGENTS (CASUALTY AGENTS)	[redacted] NONPERSISTENT EFFECT AGENTS [redacted] PERSISTENT EFFECT AGENTS [redacted] ALL NERVE AGENTS	ALL MARKINGS IN GREEN ON GRAY BACKGROUND
IRRITANT AGENTS (RIOT CONTROL AGENTS)	[redacted] NONPERSISTENT EFFECT AGENTS [redacted] PERSISTENT EFFECT AGENTS[2]	ALL MARKINGS IN RED ON GRAY BACKGROUND
INCENDIARIES	ALL MARKINGS IN BLACK ON LIGHT RED BACKGROUND	
SMOKES	ALL MARKINGS IN BLACK[3] ON LIGHT GREEN BACKGROUND EXCEPT WP AND PWP WHICH ARE IN LIGHT RED	
PRACTICE	[redacted]	
EXPLOSIVE COMPONENTS	[redacted] HIGH EXPLOSIVE [redacted] LOW EXPLOSIVE	

[1]All chemical munitions are still marked with the same symbol and descriptive word as under the old system except that munitions filled with irritant agents are now marked with the word "RIOT" instead of the word "GAS."

[2]Munitions filled with incapacitating agent BZ are marked as persistent effect agents.

[3]See paragraph 3.17b(3).

Figure 1. Chemical munitions markings.

h. Characteristics of Chemical-Filled Munitions.

Nomenclature	Status (standard)	Agent filling		Filled munition wt (lb)	Burning time (min)	Radius of burst (meters)
		Symbol	Weight (lb)			
Burster, incendiary, field, M4	A	Incendiary	*0.26	2.25	NA	35
Candle, smoke, oil, SGF2 M6	A	SGF2	.22	1.80	1 to 2	NA
Canister, green smoke, 105-mm shell, M2.	A	GS	.90	40.3	2	NA
Canister. green smoke, 155-mm shell, M3.	A	GS	3.31	86.44	1 to 3	NA
Canister, green smoke, 155-mm shell, M4.	A	GS	1.65	86.4	½ to 3	NA
Canister, red smoke, 105-mm shell, M2.	A	RS	.97	40.5	2	NA
Canister, red smoke, 155-mm shell, M3.	A	RS	3.31	86.4	1 to 3	NA
Canister, red smoke, 155-mm shell, M4.	A	RS	1.65	86.4	½ to 3	NA
Canister, smoke, HC, 105-mm shell, M1.	A	HC	1.65	42.7	3	NA
Canister, smoke, HC, 155-mm shell, M1.	A	HC	5.80	95.1	2 to 4	NA
Canister, smoke, HC, 155-mm shell, M2.	A	HC	3.00	94.35	1 to 4	NA
Canister, smoke, WP, 5-in. projectile, M5.	A	WP	7.06	NA	NA	NA
Canister, violet smoke, 105-mm shell, M2.	B	VS	.97	40.3	2	NA
Canister, violet smoke, 155-mm	B	VS	3.31	86.4	1 to 3	NA

See footnotes at end of table.

Five-element marking system		Standard color coding system		Maximum range (meters)	Storage group	Remarks
Bands		Number and color of bands	Base (primary use)			
Number	Color					
1	Yellow (Base color OD).	1 yellow	Light red; black lettering.	NA	D	Burster is used with field-improvised incendiary munitions; one burster for small container; two bursters for 55-gal. drums. TB 3–300–2 and TM 3–500.
1	Yellow	None	Light green; black lettering.	NA	D	Standard U.S. Navy munition.
1	Yellow	None	Light green; black lettering.	NA	D	Component of M84 base-ejection shell. TM 3–300 and TM 9–1300–203.
1	Yellow	None	Light green; black lettering.	NA	D	Component of M116B1 base-ejection shell. TM 3–300 and TM 9–1300–203.
1	Yellow	None	Light green; black lettering.	NA	D	Component of M116B1 base-ejection shell. TM 3–300 and TM 9–1300–203.
1	Yellow	None	Light green; black lettering.	NA	D	Component of M84 base-ejection shell. TM 3–300 and TM 9–1300–203.
1	Yellow	None	Light green; black lettering.	NA	D	Component of M116B1 base-ejection shell. TM 3–300 and TM 9–1300–203.
1	Yellow	None	Light green; black lettering.	NA	D	Component of M116B1 base-ejection shell. TM 3–300 and TM 9–1300–203.
1	Yellow	None	Light green; black lettering.	NA	D	Component of M84 base-ejection shell. TM 3–300 and TM 9–1300–203.
1	Yellow	None	Light green; black lettering.	NA	D	Component of M116B1 base-ejection shell. TM 3–300 and TM 9–1300–203.
1	Yellow	None	Light green; black lettering.	NA	D	Component of M116B1 base-ejection shell. TM 3–300 and TM 9–1300–203.
1	Yellow	None	Light green; light red lettering.	NA	C	Component of Mk 30 5-in. WP smoke projectile; Navy munition. TM 3–300.
1	Yellow	None	Light green; black lettering.	NA	D	Component of M84 base-ejection shell. TM 3–300 and TM 9–1300–203.
1	Yellow	None	Light green;	NA	D	Component of M116B1

h. Characteristics of Chemical-Filled Munitions—Continued

Nomenclature	Status (standard)	Agent filling		Filled munition wt (lb)	Burning time (min)	Radius of burst (meters)
		Symbol	Weight (lb)			
shell, M3.						
Canister, violet smoke, 155-mm shell, M4.	B	VS	1.65	86.4	½ to 3	NA
Canister, yellow smoke, 105-mm shell, M2.	A	YS	0.84	40.1	2	NA
Canister, yellow smoke, 155-mm shell, M3.	A	YS	2.98	86.4	1 to 3	NA
Canister, yellow smoke, 155-mm shell, M4.	A	YS	1.68	86.4	½ to 3	NA
Capsule, CN	B	CN	1 gram	NA	See remarks.	NA
Capsule, CS	A	CS	1 gram	NA	See remarks.	NA
Cartridge, gas, GB, nonpersistent, 105-mm how., M360.	A	GB	1.63	35.59	NA	NA
Cartridge, gas, nonpersistent, CG, 4.2-in. mortar, M2.	B	CG	6.25	23.80	NA	40
Cartridge, gas, nonpersistent, CK, 4.2-in. mortar, M2 and M2A1.	B	CK	5.0	23.0	NA	NA
Cartridge, gas, persistent, H, 4.2-in. mortar, M2.	B	H	6.20	23.70	NA	40
Cartridge, gas, persistent, HD, 4.2-in. mortar, M2.	B	HD	6.00	23.50	NA	40

See footnotes at end of table.

Five-element marking system		Standard color coding system		Maximum range (meters)	Storage group	Remarks
Bands		Number and color of bands	Base (primary use)			
Number	Color					
			black lettering.			hase-ejection shell. TM 3–300 and TM 9–1300–203.
1	Yellow	None	Light green; hlack lettering.	NA	D	Component of M116B1 hase-ejection shell. TM 3–300 and TM 9–1300–203.
1	Yellow	None	Light green; hlack lettering.	NA	D	Component of M84 hase-ejection shell. TM 3–300 and TM 9–1300-203.
1	Yellow	None	Light green; hlack lettering.	NA	D	Component of M116B1 hase-ejection shell. TM 3–300 and TM 9–1300–203.
1	Yellow	None	Light green; hlack lettering.	NA	D	Component of M116B1 hase-ejection shell. TM 3–300 and TM 9–1300–203.
[b] 1	Red [b]	1 Red [b]	Gray; red lettering.[b]	NA	B	One gram of agent in gelatin capsule; for training use in gas chamher. Use one capsule per 1,000 cu ft of chamher; will give a concentration of 25–35 mg/m³. Add capsule as required to maintain concentration. FM 21–48 and TC 3–9.
[b] 1	Red [b]	1 Red [b]	Gray; red lettering.[b]	NA	B	0.75 gram of agent in gelatin capsule; for training use in gas chamher. Use one capsule per 1,000 cu ft of chamher; will give a concentration of 20–25 mg/m³. Add capsule as required to maintain concentration. FM 21–48 and TC 3–9.
1	Green	3 Green	Gray; green lettering.	11,150	A	TM 9–1300–203.
1	Green	1 Green	Gray; green lettering.	4,515	B	TM 9–1300–205 and FM 3–5.
1	Green	1 Green	Gray; green lettering.	4,515	B	TM 9–1300–205.
2	Green	2 Green	Gray; green lettering.	4,515	A	TM 9–1300–205 and FM 3–5.
2	Green	2 Green	Gray; green lettering.	4,515	A	TM 9–1300–205.

h. Characteristics of Chemical-Filled Munitions—Continued

Nomenclature	Status (standard)	Agent filling		Filled munition wt (lb)	Burning time (min)	Radius of burst (meters)
		Symbol	Weight (lb)			
Cartridge, gas, persistent, HD, 4.2-in. mortar, M2A1.	A	HD	6.00	23.5	NA	
Cartridge, gas, persistent, HT, 4.2-in. mortar, M2.	B	HT	5.75	23.30	NA	40
Cartridge, green smoke, BE, 105-mm how., M84.	A	GS	5.12	30.48	1 to 4	NA
Cartridge, red smoke, BE, 105-mm how., M84.	A	RS	5.32	30.68	1 to 4	NA
Cartridge, smoke, FM, 4.2-in. mortar, M2.	B	FM	7.50	25.10	NA	40
Cartridge, smoke, HC, BE, 105-mm how., M84.	A	HC	7.50	32.86	1 to 4	NA
Cartridge, smoke, PWP, 4.2-in. mortar, M2.	B	PWP	6.25	23.80	NA	[c] 20 to 50
Cartridge, smoke, WP, 57-mm rifle, M308A1.	C	WP	.37	2.75	NA	[c] 15 to 20
Cartridge, smoke, WP, 60-mm mortar, M302.	C	WP	.76	3.98	NA	[c] 15 to 20
Cartridge, smoke, WP, 81-mm mortar, M57A1.	C	WP	4.06	12.38	NA	[c] 20 to 30
Cartridge, smoke, WP, 90-mm gun, M313.	B	WP	1.97	23.64	NA	[c] 15 to 30
Cartridge, smoke, WP, 105-mm how., M60.	A	WP	4.06	34.83	NA	[c] 20 to 40
Cartridge, smoke, WP, 4.2-in. mortar, M2.	B	WP	7.50	25.10	NA	[c] 20 to 50
Cartridge, smoke, WP, 4.2-in. mortar, M328.	A	WP	8.14	28.66	NA	[c] 20 to 50
Cartridge, smoke, WP, 4.2-in. mortar, M328B1.	B	WP	8.14	28.66	NA	[c] 20 to 50
Cartridge, smoke, WP, 4.2-in. mortar, M2A1.	B	WP	6.25	23.00	NA	[c] 20 to 50
Cartridge, yellow smoke, BE, 105-mm how., M84.	A	YS	4.92	30.29	1 to 4	NA

See footnotes at end of table.

Five-element marking system		Standard color coding system		Maximum range (meters)	Storage group	Remarks
Bands		Number and color of bands	Base (primary use)			
Number	Color					
2	Green	2 Green	Gray; green lettering.	4,515	A	TM 9–1300–205.
2	Green	2 Green	Gray; green lettering.	4,515	A	TM 9–1300–205.
1	Yellow	None	Light green; white lettering.	11,150	D	Base-ejection type shell. TM 9–1300–203.
1	Yellow	None	Light green; white lettering.	11,150	D	Base-ejection type shell. TM 9–1300–203.
1	Yellow	None	Light green; black lettering.	4,515	B	TM 9–1300–205.
1	Yellow	None	Light green; white lettering.	11,150	D	Base-ejection type shell. TM 9–1300–203.
1	Yellow	None	Light green; light red lettering.	4,515	C	TM 9–1300–205.
1	Yellow	None	Light green; light red lettering.	4,120	C	TM 9–1300–204.
1	Yellow	None	Light green; light red lettering.	1,470	C	TM 9–1300–205.
1	Yellow	None	Light green; light red lettering.	2,190	C	TM 9–1300–205.
1	Yellow	None	Light green; light red lettering.	17,800	C	TM 9–1300–203.
1	Yellow	None	Light green; light red lettering.	11,250	C	TM 9–1300–203.
1	Yellow	None	Light green; light red lettering.	4,515	C	TM 9–1300–205.
1	Yellow	None	Light green; light red lettering.	4,515	C	This round is a modification of the M2A1 WP smoke round. TM 9–1300–205.
1	Yellow	None	Light green; light red lettering.	4,515	C	TM 9–1300–205.
1	Yellow	None	Light green; light red lettering.	4,515	C	TM 9–1300–205.
1	Yellow	None	Light green; white lettering.	11,250	D	Base-ejection type shell. TM 9–1300–203.

h. Characteristics of Chemical-Filled Munitions—Continued

Nomenclature	Status (standard)	Agent filling		Filled munition wt (lb)	Burning time (min)	Radius of burst (meters)
		Symbol	Weight (lb)			
Cartridge, 75-mm, smoke, WP, M311.	C	WP	1.35	22.78	NA	[c] 20 to 30
Cartridge, 76-mm, smoke, WP, M361.	A	WP	1.38	23.0	NA	[c] 20 to 30
Cartridge, 81-mm, smoke, WP, M370.	A	WP	1.60	9.34	NA	[c] 20 to 30
Cartridge, 90-mm, smoke, WP, M313C.	A	WP	1.97	23.57	NA	
Cartridge, 105-mm, gas, HD, M60	A	HD	3.00	43.27	NA	NA
Cryptographic equipment destroyer, incendiary, TH1, M1A1.	B	TH1	28.00	34.00	1	NA
Cryptographic equipment destroyer, incendiary, TH1, M1A2.	B	TH1	28.00	34.00	1	NA
Cryptographic equipment destroyer, incendiary, TH1, M2A1.	B	TH1	8.50	11.50	1	NA
Cryptographic equipment destroyer, incendiary, TH4, M1A2.	A	TH4	28.00	34.00	1	NA
Cryptographic equipment destroyer, incendiary, TH4, M2A1.	A	TH4	28.00	34.00	1	NA
Document destroyer, emergency, incendiary, M3.	A	Incendiary	95.00	117.00	20	NA
File destroyer, incendiary, ABC–M4.	A	Incendiary	72.00	160.00	30	NA
Grenade, hand and rifle, smoke,	A	WP	.94	1.69	1	35

See footnotes at end of table.

Five-element marking system		Standard color coding system		Maximum range (meters)	Storage group	Remarks
Bands		Number and color of bands	Base (primary use)			
Number	Color					
1	Yellow	None	Light green; light red lettering.	6,420	C	For use with M20 75-mm rifle; very limited incendiary effect; used for spotting purposes. TM 9–1300–204.
1	Yellow	None	Light green; light red lettering.	14,250	C	Limited incendiary effects; used for spotting purposes. TM 9–1300–203.
1	Yellow	None	Light green; light red lettering.	2,190	C	TM 9–1300–205.
1	Yellow	None	Light green; light red lettering.	17,800	C	TM 9–1300–203.
2	Green	2 Green	Gray; green lettering.	11,250	A	TM 9–1300–203.
1	Purple	None	Light red; black lettering.	NA	D	For destruction of cryptographic equipment. TM 3–300.
1	Purple	None	Light red; black lettering.	NA	D	For destruction of cryptographic equipment. TM 3–300.
1	Purple	None	Light red; black lettering.	NA	D	For destruction of cryptographic equipment. TM 3–300.
1	Purple	None	Light red; black lettering.	NA	D	For destruction of cryptographic equipment. TM 3–300.
1	Purple	None	Light red; black lettering.	NA	D	For destruction of cryptographic equipment. TM 3–300.
1	Purple [b]	None	Light red; black lettering.	NA	D	Burning-type munition; filling includes 95 lb of sodium nitrate; 4¼-lb igniter charge. For destruction of documents in 55-gal. drum by burning. TB 3–300–1.
1	Purple [b]	None	Light red; black lettering.	NA	D	Destroys classified material in 3- or 4-drawer filing cabinets by use of 44 oxidizer boxes filled with sodium nitrate. Igniters and instructions furnished in shipping container. TM 3–300.
1	Yellow	1 Yellow	Light green;	35 by	C	Bursting-type munition;

h. Characteristics of Chemical-Filled Munitions—Continued

Nomenclature	Status (standard)	Agent filling		Filled munition wt (lb)	Burning time (min)	Radius of burst (meters)
		Symbol	Weight (lb)			
WP, M34.						
Grenade, hand, green smoke, M18	A	GS	.73	1.20	1	NA
Grenade, hand, incendiary, TH3, AN–M14.	A	TH3	1.65	2.00	½	NA
Grenade, hand, red smoke, M18	A	RS	.73	1.20	1	NA
Grenade, hand, riot, CN1, ABC–M25A1.	B	CN1	.22	.47	NA	5
Grenade, hand, riot, CN1 ABC–M25A2.	A	CN1	.22	.50	NA	5
Grenade, hand, riot, CN–DM, M6	B	CN–DM	.64	1.06	1	NA
Grenade, hand, riot, CN–DM, M6A1.	A	CN–DM	.59	1.25	1	NA
Grenade, hand, riot, CN, M7	B	CN	.64	1.06	1	NA
Grenade, hand, riot, CN, M7A1	A	CN	.79	1.16	1	NA

See footnotes at end of table.

Five-element marking system		Standard color coding system		Maximum range (meters)	Storage group	Remarks
Bands		Number and color of bands	Base (primary use)			
Number	Color					
			light red lettering.	hand; no data for rifle ranges.[d]		used for antipersonnel, smoke screening, and incendiary effects; 4 to 5-second fuze delay. TM 3–300 and FM 23–30.
1	Yellow	None	Light green; black lettering.	35 by hand; 145 by rifle.[d]	D	Burning-type grenade; ignition by 1 to 2-second delay fuze; for signaling; grenade top painted green for smoke color identification. TM 3–300, FM 23–30 and FM 21–60.
1	Purple	None	Light red; black lettering.	25 by hand; 120 by rifle.[d]	D	Burning-type grenade; ignited by 2-second delay fuze; provides intense heat for destruction of metal equipment. TM 3–300 and FM 23–30.
1	Yellow	None	Light green; black lettering.	35 by hand; 145 by rifle.[d]	D	Burning-type grenade; ignition by 1 to 2-second delay fuze; for signaling; grenade top painted red for smoke color identification. TM 3–300, FM 23–30, and FM 21–60.
1	Red [b]	1 Red	Gray; red lettering.	40	D	Bursting-type grenade with 1½ to 3-second delay detonating fuze; for riot control. TM 3–300 and FM 23–30.
None	Red	1 Red	Gray; red lettering.	40	D	Special-purpose bursting-type munition to control riots. TM 3–300, TB CML 58, and FM 23–30.
1	Red	1 Red	Gray; red lettering.	35 by hand; 145 by rifle.[d]	D	A special-purpose burning-type munition; 2-second delay fuze; filled with CN–DM mix. TM 3–300.
1	Red	1 Red	Gray; red lettering.	35 by hand; 145 by rifle.[d]	D	Special-purpose burning-type munition; filled with CN–DM mix. TM 3–300 and TB 3–300–1.
1	Red	1 Red	Gray; red lettering.	35 by hand; 145 by rifle.[d]	D	Burning-type grenade; ignition by 1 to 2-second delay fuze; for training and riot control. TM 3–300 and FM 23–30.
1	Red	1 Red	Gray; red lettering.	35 by hand; 145 by	D	Burning-type grenade; ignition by 2-second delay fuze; for training and

h. Characteristics of Chemical-Filled Munitions—Continued

Nomenclature	Status (standard)	Agent filling		Filled munition wt (lb)	Burning time (min)	Radius of burst (meters)
		Symbol	Weight (lb)			
Grenade, hand, riot, CS, M7A1	B	CS	.59	.96	¼ to ½	NA
Grenade, hand, riot, CS, M7A2	A	CS	.59	1.00	¼ to ½	NA
Grenade, hand, riot, CS1, M25A2	A	CS1	.22	.50	NA	5
Grenade, hand, riot, DM1, ABC–M25A2.	A	DM1	.14	.50	NA	5
Grenade, hand, smoke, HC, AN–M8.	A	HC	1.20	1.60	2	NA
Grenade, hand, smoke, WP, M15	C	WP	.95	1.93	1	35
Grenade, hand, violet smoke, M18	A	VS	.72	1.20	1	NA
Grenade, hand, yellow smoke, M18	A	YS	.73	1.20	1	NA
Grenade, rifle, green smoke, M22A2.	C	GS	.40	1.25	¾	NA

See footnotes at end of table.

Five-element marking system		Standard color coding system		Maximum range (meters)	Storage group	Remarks
Bands		Number and color of bands	Base (primary use)			
Number	Color					
				rifle.[d]		riot control; projected from rifle by grenade adapter. TM 3–300 and FM 23–30.
1	Red	1 Red	Gray; red lettering.	35 by hand; 145 by rifle.[d]	D	Special-purpose burning-type munition to control riots. TB CML 57 and FM 23–30.
1	Red	1 Red	Gray; red lettering.	35 by hand; 145 by rifle.[d]	D	Special-purpose burning-type munition to control riots. TB CML 57 and FM 23–30.
1	Red	1 Red	Gray; red lettering.	40	D	Special-purpose bursting-type munition to control riots. TM 3–300, TB CML 58, and FM 23–30.
1	Red	1 Red	Gray; red lettering.	40	D	Special-purpose bursting-type munition to control riots. TM 3–300, TB CML 58, and FM 23–30.
1	Yellow	None	Light green; black lettering.	35 by hand; 145 by rifle.[d]	D	Burning-type grenade; ignition by 1 to 2-second delay fuze; for signaling or screening. TM 3–300, FM 23–30, and FM 21–60.
1	Yellow	1 Yellow	Light green; light red lettering.	40 by hand only.	D	Bursting-type grenade with 2½ to 6-second delay detonating fuze. For screening, casualty, or incendiary effect; signaling; or target designation. TM 3–300 and FM 23–30.
1	Yellow	None	Light green; black lettering.	35 by hand; 145 by rifle.[d]	D	Burning-type grenade; ignition by 1 to 2-second delay fuze; for signaling or marking; grenade top painted violet for smoke color identification. TM 3–300.
1	Yellow	None	Light green; black lettering.	35 by hand; 145 by rifle.[d]	D	Burning-type grenade; ignition by 1 to 2-second delay fuze; for signaling; grenade top painted yellow for smoke color identification. TM 3–300 and FM 23–30.
1	Yellow	None	Light green; black lettering.	200	D	Burning-type grenade with impact-type fuze; smoke color identified by one

h. Characteristics of Chemical-Filled Munitions—Continued

Nomenclature	Status (standard)	Agent filling		Filled munition wt (lb)	Burning time (min)	Radius of burst (meters)
		Symbol	Weight (lb)			
Grenade, rifle, green smoke streamer, M23.	C	GS	.40	.94	1/5	NA
Grenade, rifle, red smoke, M22A2	C	RS	.40	1.25	¾	NA
Grenade, rifle, red smoke streamer, M23.	C	RS	.40	.94	1/5	NA
Grenade, rifle, smoke, WP, M19A1	C	WP	.53	1.57	NA	[c] 10
Grenade, rifle, yellow smoke, M22A2.	C	YS	.40	1.25	¾	NA
Grenade, rifle, yellow smoke streamer, M23.	C	YS	.40	.94	1/5	NA
Ignition cylinder, flame thrower, M1.	A	NA	NA	.10	1/10 to 1/5	NA
Mine, gas, persistent VX, 2-gal., ABC–M23.	A	VX	10.5	22.75 (unfuzed)	NA	[e] ( )
Mine, land, chemical, 1-gal., HD	A	HD	9.90	11.00	NA	5
Pellet, CN, M2	A	CN	1 gram	NA	See remarks	NA

See footnotes at end of table.

Five-element marking system		Standard color coding system		Maximum range (meters)	Storage group	Remarks
Bands		Number and color of bands	Base (primary use)			
Number	Color					
						extra green band; for signaling. TM 9–1900 and FM 23–30.
1	Yellow	None	Light green; black lettering.	200	D	Burning-type grenade; fuze ignited by muzzle blast from propelling cartridge; for signaling; for training only. TM 9–1900 and FM 23–30.
1	Yellow	None	Light green; black lettering.	200	D	Burning-type grenade with impact-type fuze; smoke color identified by one extra red band; for signaling. TM 9–1900 and FM 23–30.
1	Yellow	None	Light green; black lettering.	200	D	Burning-type grenade; fuze ignited by muzzle blast from propelling cartridge; for signaling; for training only. TM 9–1900 and FM 23–30.
1	Yellow	None	Light green; light red lettering.	195	C	Bursting-type grenade with impact-type fuze; for screening, casualty effect, or incendiary use. TM 9–1900 and FM 23–30.
1	Yellow	None	Light green; black lettering.	200	D	Burning-type grenade with impact-type fuze; smoke color identified by one extra yellow band; for signaling; for training only. TM 9–1900 and FM 23–30.
1	Yellow	None	Light green; black lettering.	200	D	Burning-type grenade; fuze ignited by muzzle blast from propelling cartridge; for signaling; for training only. TM 9–1900 and FM 23–30.
None	None [b]	None	Light red; black lettering.[b]	NA	D	Two cylinders are packaged in a metal container; for use with portable flamethrower only. TM 3–376 and SM 3–1–1300.
2	Green	3 Green; 1 Yellow.	Gray; green lettering.	NA	A	Used as antitank mine or as antipersonnel mine. TB CML 76, TM 9–1940, and TM 3–300.
2	Green	2 Green	Gray; green lettering.	NA	A	TM 3–300.
None	[b] ( )	None	Gray; red	NA	B	One gram of CN in pellet

h. Characteristics of Chemical-Filled Munitions—Continued

Nomenclature	Status (standard)	Agent filling		Filled munition wt (lb)	Burning time (min)	Radius of burst (meters)
		Symbol	Weight (lb)			
Projectile, gas, nonpersistent GB, 155-mm gun, M122.	B	GB	6.50	[f] 97.78	NA	
Projectile, gas, nonpersistent, GB, 155-mm how., M121.	B	GB	6.5	101.23	NA	
Projectile, gas, nonpersistent, GB, 155-mm how., M121A1.	A	GB			NA	[e] ( )
Projectile, gas, nonpersistent, GB, 8-in. how., M426.	A	GB			NA	[e] ( )
Projectile, gas, persistent, H, 155-mm how., M110.	A	H	11.70	94.49	NA	[e] ( )
Projectile, gas, persistent, HD, 155-mm gun, M104.	B	HD	11.70	[f] 94.81	NA	[c] 18 to 60
Projectile, gas, persistent, HD, 155-mm how., M110.	A	HD	9.70	94.00	NA	
Projectile, gas, persistent, VX, 155-mm how., M121A1.	A	VX			NA	[e] ( )
Projectile, gas, persistent, VX, 8-in. how., M426.	A	VX			NA	[e] ( )
Projectile, green smoke, BE, 155-mm how., M116B1.	B	GS	17.19	86.44	½ to 4	NA
Projectile, gun, 5″/38 (WP), Mk 30.	A	WP	7.06	54	NA	[e] 50
Projectile, red smoke, BE, 155-mm how., M116B1.	A	RS	17.19	86.44	½ to 4	NA
Projectile, smoke, HC, BE, 155-mm how., M116B1.	B	HC	25.84	94.35	1 to 4	NA

See footnotes at end of table.

Five-element coding system		Standard color marking system		Maximum range (meters)	Storage group	Remarks
Bands		Number and color of bands	Base (primary use)			
Number	Color					
			lettering.[b]			form; filling identification on shipping container; for training use in gas chamber. FM 21-48 and TC 3-9. (See Capsule, above.)
1	Green	3 Green	Gray; green lettering.	22,600	A	TM 9-1300-203.
1	Green	3 Green	Gray; green lettering.	22,610	A	Also authorized for use with 155-mm guns, fired with normal charge only. TM 9-1300-203.
1	Green	3 Green	Gray; green lettering.		A	
1	Green	3 Green	Gray; green lettering.		A	
2	Green	2 Green	Gray; green lettering.	14,850	A	TM 9-1300-203.
2	Green	2 Green	Gray; green lettering.	23,500	A	For 155-mm gun M2-M2A1, and M46. TM 9-1300-203.
2	Green	2 Green	Gray; green lettering.	14,850	A	TM 9-1300-203.
2	Green	3 Green	Gray; green lettering.		A	
2	Green	3 Green	Gray; green lettering.		A	
1	Yellow	None	Light green; white lettering.	8,820	D	Base-ejection type shell; also authorized for use with 155-mm guns, fired with normal charge only. TM 9-1300-203.
1	Yellow	1 Yellow	Light green; light red lettering.	15,800		U.S. Navy item.
1	Yellow	None	Light green; white lettering.	8,820	D	Base-ejection type shell; also authorized for use with 155-mm guns, fired with normal charge only. TM 9-1300-203.
1	Yellow	None	Light green; white lettering.	8,820	D	Base-ejection type shell; also authorized for use with 155-mm guns, fired with normal charge only. TM 9-1300-203.

h. Characteristics of Chemical-Filled Munitions—Continued

Nomenclature	Status (standard)	Agent filling		Filled munition wt (lb)	Burning time (min)	Radius of burst (meters)
		Symbol	Weight (lb)			
Projectile, smoke, WP, 155-mm gun, M104.	B	WP	15.60	[f] 98.71	NA	18 to 60
Projectile, smoke, WP, 155-mm gun, M110.	A	WP	14.60	97.50	NA	18 to 60
Projectile, smoke, 5"/54, Mk 48	A	WP	5.50	70.0	NA	
Projectile, smoke, 6"/47, Mk 41	A	WP	12.0	[f] 105.0	NA	
Projectile, violet smoke, BE, 155-mm how., M116B1.	C	VS	17.19	86.44	½ to 4	NA
Projectile, violet smoke, BE, 155-mm how., M116.	C	VS	17.19	86.44	½ to 4	NA
Projectile, yellow smoke, BE, 155-mm how., M116B1.	B	YS	17.19	86.44	½ to 4	NA
Projectile, 120-mm, smoke, WP-T, M357.	A	WP	7.51	50.3	NA	[e] 50
Projectile, 155-mm, how., smoke, WP, M105.	C	WP	15.60	98.21	NA	18 to 60
Rocket, gas, nonpersistent GB, 115-mm, M55.	A	GB	10.75	55	NA	[e] ( )
Rocket, gas, persistent VX, 115-mm, M55.	A	VX	10.20	56	NA	[e] ( )
Rocket, HVAR, smoke, PWP, 5.0-in., Mk 4 Mod 1.	A	PWP	19.30	89.9	NA	[e] 50.0
Rocket, smoke, WP, 3.5-in., M30	C	WP	2.23	8.90	NA	[e] 10 to 15

See footnotes at end of table.

Five-element marking system		Standard color coding system		Maximum range (meters)	Storage group	Remarks
Bands		Number and color of bands	Base (primary use)			
Number	Color					
1	Yellow	None	Light green; light red lettering.	23,500	C	For 155-mm gun M2, M2A1, and M46. TM 9–1300–203.
1	Yellow	None	Light green; light red lettering.	14,850	C	For 155-mm gun M2, M2A1, and M46. TM 9–1300–203.
1	Yellow	1 Yellow	Light green; light red lettering.	----------	C	U.S. Navy base-ejection smoke round; canister interchangeable for use with both the 5″/38 and 5″/54 smoke rounds.
1	Yellow	1 Yellow	Light green; light red lettering.	----------	C	U.S. Navy base-ejection smoke round.
1	Yellow	None	Light green; white lettering.	8,810	D	For training or demonstrations only. TM 9–1300–203.
1	Yellow	None	Light green; white lettering.	8,810	D	Base-ejection type shell; for training only. TM 9–1300–203.
1	Yellow	None	Light green; white lettering.	8,810	D	Base-ejection type shell; also authorized for use with 155-mm guns, fired with normal charge only. TM 9–1300–203.
1	Yellow	None	Light green; light red lettering.	[g] 26,950	C	For use in M58 gun; projectile and propelling charge are separate units. TM 9–1300–203.
1	Yellow	None	Light green; light red lettering.	9,800	C	This projectile is similar to the M110; used for training purposes only; authorized for use with 155-mm gun, fired with normal charge only. TM 9–1300–203.
1	Green	3 Green, 1 Yellow.	Gray; green lettering.	12,000	A	Complete round consists of point detonating fuze, warhead, rocket motor, and fin assembly. TM 3–500.
2	Green	3 Green, 1 Yellow.	Gray; green lettering.	12,000	A	Complete round consists of VT fuze, warhead, rocket motor, and fin assembly; 78 in. long. TM 3–500.
1	Yellow	1 Brown [h]	Light green; light red lettering.	10,150	C	Air to surface by Navy only. This round is employed for marking targets or for filling holes in smoke screen.
1	Yellow	1 Brown [h]	Light green;	850	C	TM 9–1900 and TM 9–1950.

h. Characteristics of Chemical-Filled Munitions—Continued

Nomenclature	Status (standard)	Agent filling		Filled munition wt (lb)	Burning time (min)	Radius of burst (meters)
		Symbol	Weight (lb)			
Rocket, smoke, WP, 4.5-in., Mk 10 Mod 0.	A	WP	12.10	28.80	NA	
Rocket, smoke, WP, 5-in., Mk 30	A	WP				
Signal, ground, green smoke, PARA, M128E1.	A	GS	.16	1.16	¼	NA
Signal, ground, red smoke, PARA, M129E1.	A	RS	.16	1.16	¼	NA
Signal, smoke marine, AN–Mk 1, Mod 1.	A		.13	.38	3/10	NA
Smoke pot, floating, HC, M4A2.	B	HC	27.50	38.00	10 to 15	NA
Smoke pot, floating, SGF2, AN–M7.	A	SGF2	13.00	40.00	12 to 17	NA
Smoke pot, floating, SGF2, Mk 5 Mod 2.	C	SGF2	13.00	39.00	12 to 17	NA
Smoke pot, HC, M1	B	HC	9.5 to 11	12.5	5 to 8	NA
Smoke pot, HC, 30-lb., M5	A	HC	31.00	33.00	12 to 22	NA
Starter, fire, NP3, M2	A	NP3	.01	.03	4	NA
Starter, fire, NP3, M1	B	NP3	.05	.16	13	NA

See footnotes at end of table.

Five-element marking system		Standard color coding system		Maximum range (meters)	Storage group	Remarks
Bands		Number and color of bands	Base (primary use)			
Number	Color					
			light red lettering.			
1	Yellow	1 Brown [b]	Light green; light red lettering.	1,130	C	Fired from launcher M20 or M20B1. TM 9–1950.
1	Yellow	1 Yellow	Light green; light red lettering.	[c] ( )	C	Equipped with WP smoke canister; Navy use only.
None	NA	None	Light green; black lettering.	200	D	FM 23–30.
1	Yellow	None	Light green; black lettering.	200	D	FM 23–30.
		None		NA	D	Used primarily by Navy.
1	Yellow	None	Light green; black lettering.	NA	D	Burning-type pot; ignition by M208 fuze; 10 to 20-second delay in production of smoke. TM 3–300.
1	Yellow	None	Light green; black lettering.	NA	D	Thermal generator type pot; ignition by M208 fuze or M209 electrical fuze; 8 to 20-second delay in production of smoke. TM 3–300.
1	Yellow	None	Light green; black lettering.	NA	D	Thermal generator type pot; ignition by M208 fuze or M209 electrical fuze; 8 to 20-second delay in production of smoke. TM 3–300.
1	Yellow	None	Light green; black lettering.	NA	D	Burning-type pot; ignited by match head and scratcher block; 10-second delay in production of smoke; for training only. TM 3–300.
1	Yellow	None	Light green; black lettering.	NA	D	Burning-type pot; ignited by match head and scratcher block or electric squib; 20 to 30-second delay in production of smoke. TM 3–300.
None	None [b]	None	Light red; black lettering.	NA	D	One end of munition is painted light red. TM 3–300.
None	None [b]	None	Light red; black lettering.	NA	D	TM 3–300.

h. Characteristics of Chemical-Filled Munitions—Continued

Nomenclature	Status (standard)	Agent filling		Filled munition wt (lb)	Burning time (min)	Radius of burst (meters)
		Symbol	Weight (lb)			
Warhead, 762-mm rocket, gas, nonpersistent GB, M79.	B	GB	396	1600 ± 20	NA	[e] ( )

[a] Weight of burning mix only.
[b] Color markings on container only.
[c] Burst radius in meters for antipersonnel effect. See FM 3-5 for other effects.
[d] For use with M1 rifle only, equipped with M1A1 chemical grenade adapter.
[e] Information is classified.
[f] Weight without fuze, grommet, and lifting plug.
[g] Range for similar type projectile but filled with HE.
[h] Band on rocket motor assembly only.

Five-element marking system		Standard color coding system		Maximum range (meters)	Storage group	Remarks
Bands		Number and color of bands	Base (primary use)			
Number	Color					
1	Green_____	3 Green, 1 Yellow.	Gray; green lettering.	[e] ( )_____	A	HONEST JOHN.

i. Characteristics of Fire, Incendiary, Gas, and Smoke Bombs.

Nomenclature	Status (standard)	Weight of complete round (lb)	Filling data		Nominal size (lb)	Dimensions (overall-unpacked) (in.)	Five-element marking system	
			Type	Weight (lb)			Bands	
							No.	Color
Bomb, fire, 750-lb, M116A1.	C	685	Thickened fuel.	* 610.3	750	48⅝ x 18⅝	Red background, decalcomania only.	
Bomb, fire, 750-lb, M116A2.	A	680	Thickened fuel.	610.3	750	Center section 48⅝ x 18⅝.	Red background, decalcomania only.	
Bomb, gas, nonpersistent CG or CK, 500-lb, AN-M78.	C	496 467	CG CK	205 176	500	59 x 19 11/16	1	Green
Bomb, gas, nonpersistent CK or CG, 1,000-lb, AN-M79.	C	948 884	CG CK	415 351	1,000	69½ x 18¾	1	Green
Bomb, gas, nonpersistent GB, 10-lb, M125.	C	8.5	GB	2.6	10	12 x 3⅝	1	Green
Bomb, gas, nonpersistent GB, 10-lb, M125A1.	A	8.5	GB	2.6	10	12 x 3⅝	1	Green
Bomb, gas, nonpersistent, GB, 750-lb, MC-1.	A	710	GB	220	750	90 x 16 (with M131 tail assembly).	1	Green
Bomb, gas, persistent H, 115-lb, M70.	C	128	H	50	115	51½ x 8 3/32	2	Green
Bomb, gas, persistent HD, 115-lb, M70A1.	A	128	HD	60	115	51½ x 8 3/32	2	Green
Bomb, incendiary, NP, 100-lb, AN-M47A3.	C	69.8	NP	40	100	52 9/16 x 8½	1	Purple
Bomb, incendiary, PT1, 10-lb, M74.	C	8.5	PT1	2.75	10	19½ x 2⅞	1	Purple
Bomb, incendiary, PT1, 10-lb, M74A1.	A	8.5	PT1	2.75	10	19½ x 2⅞	1	Purple
Bomb, incendiary, PT1, 100-lb, AN-M47A4.	A	86.0	PT1	59.7	100	52 9/16 x 8½	1	Purple
Bomb, incendiary, TH3, 4-lb, AN-M50A3.	B	3.5	TH3	0.63	4	21 11/32 x 1⅝	1	Purple

See footnotes at end of table.

Standard color coding system		Burning time or burst rad (min) (meters)	Storage class	Shipping data					How shipped	Remarks
No. and color of bands	Base (primary use)			Weight (lb.)	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)		
None	Light red background; black lettering on decalcomania.	Eat 20 x 100 meters.	D	160	137	18.62	18.62	31.5	Disassembled in wood box.	Carried externally by high performance aircraft. TM 3-400 and TB 3-400-9.
None	Light red background; black lettering on decalcomania.	Est 20 x 100 meters.	D	160	137	18.62	18.62	31.5	Disassembled in wood box.	For use on F-100 type aircraft. TB 3-400-9.
1 Green, 1 Yellow.	Gray; green lettering.	[b] ( )	A	492 421	47.5 47.25	19.13 18.50	19.13 18.5	10.1 10.4	Shipping bands.	TM 3-400.[c]
1 Green, 1 Yellow.	Gray; green lettering.	[b] ( )	A	939 875	54.0 53.5	23.25 23.25	23.25 23.25	17.5	Shipping banda.	TM 3-400.[c]
3 Green, 1 Yellow.	Gray; green lettering.	[b] ( )	A	See M34 cluster.					Clustered.	76 bomblets per M34 cluater. TM 3-400.
3 Green, 1 Yellow.	Gray; green lettering.	[b] ( )	A	See M34A1 cluster.					Clustered.	76 bomblets per M34A1 cluster; similar to M125. except for parachute release.
3 Green, 1 Yellow.	Gray; green lettering.	[b] ( )	A	1,590	54.25	32.25	21.75	22.0	Baseplate protector, 2 per pallet.	Designed for internal or external carriage on bomber and fighter aircraft. TB 3-400-2.[c]
2 Green, 1 Yellow.	Gray; green lettering.	[b] ( )	A	135	41	12.63	12.63	3.9	Shipping bands.	TM 3-400. Used by Navy only.[c]
2 Green, 1 Yellow.	Gray; green lettering.	[b] ( )	A	135	41	12.63	12.63	3.9	Shipping banda and lug protectors.	TM 3-40J.[c]
1 Yellow.	Light red; black lettering.	10 to 15 min.	D	118	55.95	10.5	10.5	3.8	Wood box.	TM 3-400.
1 Yellow.	Light red; black lettering.	5 to 10 min.	D	See M31 bomb clusters.					Clustered.	38 bomblets per M31 cluster. TM 3-400.
1 Yellow.	Light red; black lettering.	5 to 10 min.	D	See M35 bomb clustera.					Clustered.	57 bombleta per M35 cluster; data and characteriatics are similar to those for the M74 bomb except for fuze assembly. TM 3-400.
1 Yellow.	Light red; black lettering.	10 to 15 min.	D	138	55.95	10.5	10.5	3.8	Wood box.	Components and dimensions are aimilar to thoae for the M47A3. TM 3-400.
None	Light red; black lettering.	5 to 8 min.	D	See M32 bomb clustera.					Clustered.	108 bomblets are packed and loaded in the M32 cluster. TM 3-400.

i. Characteristics of Fire, Incendiary, Gas, and Smoke Bombs—Continued

Nomenclature	Status (standard)	Weight of complete round (lb)	Filling data		Nominal size (lb)	Dimensions (overall-unpacked) (in.)	Five-element marking system	
			Type	Weight (lb)			Bands	
							No.	Color
Bomb, incendiary, TH3, 4-lb, M126.	A	3.6	TH3	0.63	4	19 9/16 x 1 5/8	1	Purple
Bomb, smoke, PWP, 100-lb, AN-M47A3.	C	105	PWP	74	100	52 9/16 x 8 1/2	1	Yellow
Bomb, smoke, PWP, 100-lb, AN-M47A4.	A	105	PWP	74	100	52 9/16 x 8 1/2	1	Yellow
Bomb, smoke, WP, 100-lb, AN-M47A4.	C	131	WP	100	100	52 9/16 x 8 1/2	1	Yellow

[a] One gallon of gasoline computed at 6.103 lb.
[b] Information classified. For other effects see FM 3–5.
[c] All shipping data are less fuzing components.

Standard color coding system		Burning time or burst rad (min) (meters)	Storage class	Shipping data					How shipped	Remarks
No. and color of bands	Base (primary use)			Weight (lb)	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)		
None	Light red; black lettering.	5 to 8 min.	D	See M36 bomb cluster.					Clustered.	Same as the M50A3 except the M126 is equipped with M15 tail-fin assembly; 182 bomblets are contained in M36 cluster. TM 3-400.
1 Yellow.	Light green; light red lettering.	20 to 30 meters.	C	153	55.95	10.5	10.5	3.7	Wood box.	Suspension lugs on the M47A3 bomb are lighter than the lugs on the M47A4 series; all other characteristics are the same. TM 3-400.[c]
1 Yellow.	Light green; light red lettering.	20 to 30 meters.	C	153	55.5	10.5	10.5	3.7	Wood box.	
1 Yellow.	Light green; light red lettering.	20 to 30 meters.	C	179	55.63	10.5	10.5	3.7	Wood box.	

j. Chemical Incendiary and Gas Bomb Clusters.

Designation	Status (standard)	Weigbt of complete cluster	Contents		Nominal size (lb)	Dimensions (overall) (in.)	Five-element marking system	
			Bomblet	Number			Bands	
							No.	Color
Cluster, gas bomb, nonpersistent GB, 1,000-lb, M34.	C	1,130	M125	76	1,000	68½ x 19⅛	1	Green
Cluster, gas bomb, nonpersistent GB, 1,000-lb, M34A1.	A	1,130	M125A1	76	1,000	68½ x 19⅛	1	Green
Cluster, incendiary bomb, PT1, 500-lb, M31.	C	562	M74	38	500	57 x 15⅛	1	Purple
Cluster, incendiary bomb, PT1, 750-lb, M35.	A	690	M74A1	57	750	90 x 16	1	Purple
Cluster, incendiary bomb, TH3, 500-lb, M32.	C	617	AN-M50A3	108	500	60 x 14⅞	1	Purple
Cluster, incendiary bomb, TH3, 750-lb, M36.	A	900	M126	182	750	90 x 16	1	Purple

[1] All shipping data are less fuzing components.
[2] Outer-shell clusters are marked the same as individual bomblets.

Standard color coding system		Storage class	Shipping data[1]						Remarks
No. and color of bands	Base (primary use)		Cubage (cu ft)	Weight (lb)	Length (in.)	Width (in.	Height (in.)	Type package	
3 green, 1 yellow.	Gray; green lettering.	A	19.1	1,130	68½	19⅛	19⅛	Shipping guard.	TM 3–400.
3 green, 1 yellow.	Gray; green lettering.	A	19.1	1,130	68½	19⅛	19⅛	Shipping guard.	TM 3–400.
1 yellow	( )[2]	D	11.8	595	52	20	20	Rolling crate.	TM 3–400.
1 yellow	( )[2]	D	17.5	835	69.56	20.44	20.44	Shipping guard.	TM 3–400.
1 yellow	( )[2]	D	9.5	660	53.5.	20	20	Rolling crate.	TM 3–400.
1 yellow	( )[2]	D	17.5	1,045	69.56	20.44	20.44	Shipping guard.	TM 3–400.

3.18. Characteristics of Portable Flamethrowers

Nomenclature	Status (standard)	Weight		Dimensions (in.)	Fuel	
		Empty (lb)	Filled (lb)		Initial cap. (gal.)	Discharge rate (gal./second)
Flamethrower, portable, M2A1	C	43	72		4.75	0.50 to 0.75
Components:						
Gun, M2A1		7		¾ (diam) x 30 (long).		
Hose, fuel, M1		1		⅞ (ID) x 37 (long).		
Tank group, M2A1		35		27 (high) x 20 (wide) x 11 (deep).		
Flamethrower, portable, M2A1–7	B	39.5	65 to 69		4.75	0.50 to 0.75
Components:						
Gun, M7		4.5		⅝ (diam) x 21 (long).		
Hose, fuel, M8		1.75		¾ (ID) x 37½ (long).		
Tank group, M2A1		35		27 (high) x 20 (wide) x 11 (deep).		
Flamethrower, portable, ABC–M9–7	A	26.0	50		4.0	0.50 to 0.75
Components:						
Gun, M7		4.50		⅝ (diam) x 21 (long).		
Hose, fuel, M8		1.75		¾ (ID) x 37½		
Tank group, M9		16.25		22½ (high) x 18 13/16 (long) x 12¼ (deep).		

[1] ***Caution:*** **Never use oxygen, hydrogen, acetylene, or other flammable gas for pressurizing.**

Duration of continuous fire (seconds)	Maximum effective range		Pressure		Remarks
	Thickened fuel (meters)	Unthickened fuel (meters)	Pressure container (psi)	Fuel container (operating pressure) (psi)	
6 to 9	40 to 50	20 to 25	1,700 to 2,100	300 to 350	Fuel ignited by incendiary charge of ignition cylinder. Weight in packing chest (including chest and contents) 112 lb. TM 3-376.
					Includes two 2½-gal. interconnected fuel tanks and one pressure tank; pressure tank charged with compressed air.[1]
6 to 9	40 to 50	20 to 25	1,700 to 2,100	300 to 350	Fuel ignited by incendiary charge of ignition cylinder. Weight in packing chest (including chest and contents) 108 lb. TM 3-1040-204-10.
					Includes 2½-gal. interconnected fuel tanks and one pressure tank; pressure tank charged with compressed air.[1]
5 to 8	40 to 50	20 to 25	2,000	300	Fuel ignited by incendiary charge of ignition cylinder. Weight in packing chest (including chest and contents) 64 lb. TM 3-500.
					Two aluminum fuel tanks and one spherical steel pressure tank; pressure tank charged with compressed air.[1]

3.19. Characteristics of Mechanized Flamethrowers

Nomenclature	Status (standard)	Vehicle weight (tons)	Fuel		Duration of continuous fire (seconds)
			Initial cap. (gal.)	Discharge rate (gal./second)	
Flamethrower, mechanized, main armament, turret-mounted, M7–6.	A	Approx. 50.5 (M67A1 tank).	380	----------	----------
Components:					
Gun, M6	----------	----------	----------	----------	----------
With 7/8-in. nozzle	----------	----------	----------	6.70	60
With 3/4-in. nozzle	----------	----------	----------	6.20	70
Fuel and pressure unit, M7	----------	----------	----------	----------	----------
Flamethrower, mechanized, main armament, turret-mounted, M7A1–6.	A	Approx. 54 (M67 tank).	380	----------	----------
Components:					
Gun, M6	----------	----------	----------	----------	----------
With 7/8-in. nozzle	----------	----------	----------	6.70	60
With 3/4-in. nozzle	----------	----------	----------	6.20	70
Fuel and pressure unit, M7A1	----------	----------	----------	----------	----------
Flamethrower, mechanized, main armament, AUV/APC, M10–8.	A	----------	200	----------	32
Components:					
Cupola group, M8	----------	----------	----------	----------	----------
Fuel and pressure group, M10	----------	----------	----------	----------	----------
Installation group	----------	----------	----------	----------	----------
Pneumatic control group	----------	8	----------	----------	----------

[1] ***Caution:*** **Never use oxygen, hydrogen, acetylene, or other flammable gas for pressurizing.**

Maximum effective range		Pressure		Remarks
Thickened fuel (meters)	Unthickened fuel (meters)	Pressure container (psi)	Fuel container (operating pressure) (psi)	
230	Not recommended.	3,000	325	Installed in M48A1 medium tank for use by Marine Corps; flame fuel ignited by spark plug and atomized gasoline and/or secondary fuel. Marine Corps Manual ORD–MM–7005.
				Mounted in dummy 90-mm gun tube.
230	Not recommended.			
185	Not recommended.			
				Includes fuel and pressure containers located in tank turret; pressure containers charged with compressed air or nitrogen.[1]
Approx. 230.	Not recommended.	3,000	325	Installed in M48A2 medium tank; flame fuel ignited by spark plug and atomized gasoline and/or secondary fuel. TM 3–1040–206–10.
				Mounted in dummy 90-mm gun tube.
230	Not recommended.			
185	Not recommended.			
				Includes fuel and pressure containers located in tank turret; pressure containers charged with compressed air or nitrogen.[1]
Approx. 230.	Not recommended.	3,000	325	Installed in the M113 armored personnel carrier only.[1] TM 3–1040–209–12 (when published).

3.20. Characteristics of ABC–M3A3 Mechanical Smoke Generator

a. General.
(1) *Status:* Standard-A.
(2) *Weight:* Empty, 190 lb. Filled, 207 lb.
(3) *Dimensions:* Length, 40 in. Width, 17 in. Height, 23 in.
(4) *Engine:* Type: pulse-jet. Description: single cycle, air cooled, 60 pulses per second. Starting method: magneto and hand-operated air pump.
(5) *Delay in smoke production after starting engine:* 30 seconds.

b. M4 Fog Oil Pump.
(1) *Description:* Air motor-oil pump combination; air motor operated by exhaust engine gases.
(2) *Capability:* 20 to 50 GPH.

c. Fog Oil Drum Operating Pressure. None.

d. Generator Mount.
(1) *¼-ton truck:* M2 mount.
(2) *¼-ton trailer:* M2 mount.

e. Fog Oil Drum Mount for ¼-ton Trailer: M3 mount.

f. Gasoline.
(1) *Tank capacity:* 3½ gal.
(2) *Octane rating:* 76 or higher.
(3) *Consumption rate:* 3 GPH.

g. Fog Oil Consumption Rate.
(1) *Minimum:* 25 GPH.[1]
(2) *Maximum:* 50 GPH.
(3) *Normal:* 40 GPH.

h. Temperature Limits for Use of Fog Oil.
(1) *SGF1:* NA.
(2) *SGF2:* Above 32° F.
(3) *75–25 mixture:*[2] 32° to 0° F.
(4) *60–40 mixture:*[3] 0° to −25° F.
(5) *40–60 mixture:*[4] −25° to −40° F.

[1] Operation at rate of 25 GPH should be limited to relatively short period to prevent damage to generator; usual minimum rate is 30 to 35 GPH.
[2] 75 parts SGF2 and 25 parts jet fuel (JP–3 or JP–4) or wax-free kerosene.
[3] 60 parts SGF2 and 40 parts jet fuel (JP–3 or JP–4) or wax-free kerosene.
[4] 40 parts SGF2 and 60 parts jet fuel (JP–3 or JP–4) or wax-free kerosene.

3.21. Characteristics of Airplane Smoke Tank, M10

Type (symbol)	Filling				Remarks
	Unit weight (lb per gal.)	Operating volume (gal.)[1]	Operating weight (lb)	Filled tank weight (lb)[2]	
CNB	9.50	30	285	353	Weight of empty M10 tank is 68 lb; maximum dimensions are 20½ in. in diameter, 14 in. high, and 84 in. long. Auxiliary equipment includes M10 set accessories, M10 insulating cover, M2A1 hand-driven pump, M3 filling line, M1 orifice, M2 hoisting beam, and M1 carrying stand.
CNC	10.88	30	326	394	
FS	16.00	30	480	548	
H	11.30	30	339	407	
HD	10.70	30	321	389	
MR[3]	8.80	30	264	332	

[1] Maximum volume of tank is 33 gal. 3-gal. void left for expansion of filling.
[2] When insulating cover is used, add approximately 40 lb.
[3] For training purposes.

Section V. CHEMICAL LANDMINES

3.22. Filling of M1 Chemical Landmines

For planning purposes, the toxic gas sections of the chemical depot company (TOE 3–67D) are considered capable of filling a total of approximately 4,320 one-gallon landmines with toxic agent from bulk containers per 12-hour period of daylight operations by means of six M2 landmine field filling apparatus. Factors causing capability to vary are weather, enemy action, location of filling operations, terrain, and type of protective clothing worn. If landmine filling is to be accomplished at night in addition to the 12-hour daytime operations, augmentation of the toxic gas sections will be necessary.

3.23. Laying of Chemical Landmines

a. Laying of M1 Chemical Landmines. Any troop unit can lay M1 chemical landmines. Advice of the staff chemical officer and advice and/or assistance of engineers should be requested as required. Capabilities of units to lay chemical landmines will vary widely because of the differences in the nature of the terrain, the tactical situation, and the training and experience of the troops involved. Capabilities of troop units to lay M1 chemical landmines are shown below. For additional information see FM 3–5.

b. Capabilities of Units to Lay M1 Chemical Landmines.

Nature of task	Squad (6 men and one 2½-ton truck) task	Platoon (4 squads) task	Company (12 squads) task	Average time required [1]	
				To install time fuze and detonating cord	To wire mines for electrical firing
Barrier contamination.[2]	300 yd wide, 100 yd deep; 300 mines.	1,300 yd wide, 100 yd deep; 1,300 mines.	5,000 yd wide, 100 yd deep; 5,000 mines.	4 hours.	8 hours.
Road contamination.[3]	1,600 yd long; 3,200 yd of cord; 330 mines.	6,400 yd long; 12,800 yd of cord; 1,320 mines.	19,200 yd long; 38,400 yd of cord; 3,960 mines.	15 to 20 minutes.	2 hours.

[1] Time increased 50 percent for night work.
[2] For surface emplacement.
[3] Detonating cord laid from truck; mines placed on cord.

c. Laying of M23 Chemical Landmines. Follow the laying and arming procedures for antitank mines outlined in FM 20–32 with the following additional procedure:

Substitute an M23 mine for any one antipersonnel mine in a cluster at a ratio of not more than one to every fourth cluster on the enemy side of the standard strip.

3.24. Quantities of Thickener and Peptizer to be Mixed with 100 Gallons of Gasoline to Produce Flame Fuels of Recommended Consistencies[1]

Gasoline temperature (° F.)	Portable flamethrowers				Mechanized flamethrowers					Landmines and field expedients [2]				
	M1 Thickener (lb)	Peptizer [3] (lb)	M4 Thickener (lb)	Peptizer [4] (lb)	M1 Thickener (lb)	Peptizer [3] (lb)	M4 Thickener (lb)	Peptizer [4] (lb)	M2 Thickener [5] (lb)	M1 Thickener (lb)	Peptizer [3] (lb)	M4 Thickener (lb)	Peptizer [4] (lb)	M2 Thickener [5] (lb)
Above 60	26.25	0	11.0	0	50.0	0	24.2	0	37.5	40.0	0	19.8	0	30.0
40 to 60	26.25	2.5	11.0	0	50.0	3.5	24.2	0	37.5	40.0	5.0	19.8	0	30.0
20 to 40	26.25	3.75	11.0	3.0	50.0	5.0	24.2	0	37.5	50.0	10.0	24.2	6.0	30.0
0 to 20	26.25	7.5	11.0	3.0	60.0	7.5	24.2	0	45.0	60.0	15.0	24.2	6.0	30.0
−15 to 0	26.25	10.0	11.0	6.0	60.0	8.75	22.0	6	45.0	70.0	17.5	26.4	12.0	19-30
−40 to −15	No gel	NA	11.0	6.0	No gel	NA	22.0	6	No gel	No gel	NA	26.4	12.0	19-30

[1] For complete details on flamethrower and fire bomb fuels, consult TM 3-366. Quantities of thickener and peptizer given in this paragraph serve only as a guide and should be modified as necessary.

[2] M1 and M2 thickeners may be used for mixing fuels for fire bombs.

[3] Cresylic acid peptizer is used with M1 and M2 thickeners when gasoline cannot be indirectly heated to the optimum temperature. This peptizer weighs 1 lb per pint; a canteen cup holds 1½ pints.

[4] 2-Ethylhexoic acid peptizer is used with M4 thickener when gasoline cannot be indirectly heated to the optimum temperature. This peptizer weighs 1.3 lb per pint; a canteen cup holds 1½ pints (2 lb).

[5] Data on M2 thickener are based upon usage with the continuous flow type mechanical mixers, which are capable of heating gasoline to the optimum temperature under most field conditions; therefore, peptizer is not required.

3.25. Nomogram for Determining Approximate Quantities of M1, M2, and M4 Thickener Required for Thickened Fuel

See figure 2 for nomogram.

(Located in back of manual)

Figure 2. Nomogram.

CHAPTER 4
CHEMICAL SUPPLY AND MAINTENANCE

Section I. INTRODUCTORY INFORMATION

4.1. General

a. Chemical Corps supply includes the determination of requirements for, and cataloging, procurement, distribution, and disposal of CBR items of materiel, both offensive and defensive, including CBR weapons such as flamethrowers; CBR munitions, such as landmines and hand grenades; smoke-producing equipment; safety and protective equipment, including protective masks and collective protection equipment; decontaminating equipment; bulk chemical agents; and commercial chemicals.

b. Chemical maintenance includes repairing, reconditioning, and reclaiming unserviceable Chemical Corps materiel, and assisting users to keep materiel in a serviceable condition.

4.2. References

a. All equipment and supplies furnished by the Chemical Corps fall into classes II, IV, and V. Publications pertaining to Chemical Corps items of supply include Army regulations, supply manuals, supply bulletins, technical manuals, and technical bulletins. Authorizations for Chemical Corps end items of supply are found in tables of organization and equipment, tables of allowances, and special authorization documents.

b. Common tables of allowances containing Chemical Corps end items follow.

TA	Title
3–102	Allowances of Chemical Corps expendable supplies for Quartermaster laundry and dry cleaning purposes.
3–103	Allowances of Chemical Corps expendable supplies for PSYWAR units.
3–104	Allowances of Chemical Corps expendable supplies.
20	Field installations and activities.
20–2	Equipment for training purposes.
20–11	Individual safety and protective clothing and equipment.
23–100	Ammunition for training.
23–101	Miscellaneous ammunition and explosives.
23–102	Annual allowances of miscellaneous ammunition and explosives.

4.3. Federal Stock Numbering System

Each item of materiel adopted as standard by the Department of Defense is assigned a Federal stock number to distinguish it from other items and to facilitate military supply management. The Federal stock number is an 11-digit number divided into 2 parts.

a. The first four digits represent the Federal supply classification (FSC) code. The first two numbers of the FSC code identify the FSC group. FSC group numbers are used to identify a group of related supply items. Groups are numbered 10–99, thus permitting 89 possible groups. A further subdivision of the FSC group divides each 2-digit FSC group into classes. Each class is designated by an additional 2 digits, thus making a 4-digit code classification. For example, FSC group 42 (fire, safety, and rescue equipment) is divided into several classes, one of which is FSC class 4240, safety and rescue equipment.

b. The remaining 7 digits represent a sequentially assigned serial number identifying a specific item. These last 7 digits are assigned to one, and only one, item of supply throughout the entire Department of Defense and are referred to as the Federal item identification number (FIIN).

c. Chemical Corps items of supply fall primarily into the following FSC classes:

1040 Chemical weapons and equipment
1365 Military chemical agents
1380 Military biological agents
3650 Chemical and pharmaceutical products manufacturing machinery
4230 Decontaminating and impregnating equipment
4240 Safety and rescue equipment
6630 Chemical analysis instruments
6640 Laboratory equipment and supplies
6665 Hazard detecting instruments and apparatus
6810 Chemicals
6820 Dyes
6840 Pest control agents and disinfectants
6850 Miscellaneous chemical specialties

4.4. Supply Cataloging System

a. Technical services are authorized by the Department of the Army to publish the following five types of supply manuals:

Type 1—Stock list of all items (except repair parts)
Type 2—Price list of all items
Type 3—Stock list of repair parts
Type 4—Components of sets, kits, and outfits
Type 5—Stock list of current issue items

Supply manuals are numbered according to a standard system to reflect the information that is contained in each manual. The first number represents the preparing technical service; the second number identifies the type of manual; succeeding numbers represent the FSC groups or classes to which the manual pertains, except in the case of type 3 supply manuals which bear succeeding numbers identifying the part and volume number of the manual. For example, a supply manual numbered 3–1–1365 would be a manual prepared by the Chemical Corps, containing a stock list of all items in FSC class 1365 (military chemical agents).

b. Some supply manuals of the Cml 6, 7, 8, and 9 series, listing repair parts allowances for Chemical Corps items of equipment, are still current and are being used; however, as these become obsolete they are being replaced by technical manuals (see par. 4.6).

SB	Title
3–24	Shipping chart for Chemical Corps ammunition, ammunition components, and military chemical agents.
3–32	Disposal of supplies and equipment, Chemical Corps ammunition.
3–33	Chemical Corps adopted items of materiel.
3–34	Maintenance float, Chemical Corps equipment.
3–37	No depot maintenance list — Chemical Corps equipment.
3–39	Basic loads of chemical nontoxic ammunition.
(C) 38–26	Ammunition day of supply (U).
38–8–1	Storage of Army supplies and equipment in shed and open storage.
710–1	Replacement factors for Army materiel, PEMA.
725–350	Chemical Corps regulated items.

4.5. Supply Bulletins and Technical Bulletins

a. Supply bulletins provide an invaluable source of technical logistical data. An index of supply bulletins may be found in DA Pam 310–4. A partial list of supply bulletins considered to be useful to the chemical planner is provided in paragraph 4.4*b*.

b. Technical bulletins contain technical information pertaining to weapons and equipment or to professional techniques. Technical bulletins may supplement technical manuals, but they will not make direct changes in the content of the manuals. Instructions published in technical bulletins may be incorporated later in technical manuals. An index of technical bulletins may be found in DA Pam 310–4.

4.6. Technical Manuals

a. Technical manuals are prepared for each item of equipment listed in appropriate authorization documents where operating and maintenance instructions are required. Technical manuals pertaining to equipment are published in multiple parts as follows:

Part I—Operator's manual
Part II—Organizational maintenance manual
Part III—Field maintenance manual—Third echelon
Part IV—Field maintenance manual—Fourth echelon
Part V—Depot maintenance manual

The repair parts and special tools needed to perform the appropriate maintenance at a specific echelon are contained in appendixes to parts II, III, IV, and V manuals. These appendixes are published separately.

b. Multiple part technical manuals, like supply manuals, are numbered to indicate the information contained in the manual. The first number is the designated number of the preparing technical service; the second group of numbers represents the FSC class assigned to the equipment covered by the manual; the third group of numbers indicates the numerical sequence of the technical manuals prepared on equipment covered by the particular FSC group or class (sequence begins with the number 200 in this group); the final two numbers signify the echelon(s) of maintenance to which the

manual applies; a suffix P attached to the final number indicates a repair parts list published separately from the maintenance instructions.
Example: TM 3–4240–204–15P
3—preparing technical service
4240—FSC class of equipment
204—numerical sequence (5th technical manual for TM 3-series within FSC class 4240)
15—echelons of maintenance (1–5)
P—repair parts list for same echelons of maintenance (1–5)

4.7. Assignment of Logistics Functions

The assignment of logistical responsibility to the technical services by the Department of the Army is accomplished by Army regulations of the 701-series. These AR's assign to the technical services, by FSC class, responsibility for performing each of the separate logistical functions (research and development, specifications and standardization, requirements and funds, purchasing and inspection, depot storage and issue, stock control and accountability, maintenance, and disposal). Normally a single technical service is assigned to perform all the logistical functions for an entire FSC class; however, the FSC class may be divided among several technical services; or, different technical services may be assigned separate logistical functions for the same FSC class. For example, the Ordnance Corps may be assigned to perform all the logistical functions for an entire FSC class except that the Chemical Corps may be assigned the logistics functions for specific items in the same FSC class. Also, the Chemical Corps may be assigned to perform the research and development function for an FSC class, and the Ordnance Corps may be assigned to perform the other logistical functions. Paragraph 4.3*c* lists the primary FSC classes in which Chemical Corps items of supply are included.

4.8. Regulated and Command-Controlled Items

a. Regulated Items. Regulated items are items which are costly, are of a highly technical or hazardous nature, or are scarce from a national standpoint. An item on the regulated items list can be deleted only through action by the Department of the Army. The theater commander, through command channels, must exercise close supervision of issues to insure proper distribution in accordance with existing priorities. Requisitions for regulated items must be processed through command channels. The theater commander will determine at what command levels various items can be approved for issue. Chiefs of technical services must exercise close supervision of regulated items for which their service has supply responsibility to insure that distribution is accomplished in accordance with priorities established by the Department of the Army. Lists of regulated items for all technical services, which are applicable worldwide, are published in supply bulletins. SB 725–350 lists Chemical Corps regulated items.

b. Command-Controlled Items. In addition to regulated items, commanders at all echelons may control other items which are in short supply or are critical in nature. In so doing they normally publish controlled items lists or directives which require the same general procedures for obtaining such supplies or equipment as for regulated items.

Section II. REQUIREMENTS

4.9. Day of Supply

A day of supply is a unit or quantity of supplies adopted as a standard of measurement used in estimating the average daily expenditure of supplies for a given force under stated conditions. Day of supply is expressed as a factor—for example, pounds of supplies per man per day or tons of supplies per division per day. When a day of supply is used for planning purposes, the number of troops or the size of the force and the type of operations for which the day of supply is applicable must be considered. Obviously, the number of men to be supported, and whether the force will be conducting an amphibious or airborne landing, will affect the total tonnage of supplies required. Day of sup-

ply planning data by supply class (I, II, III, and so forth) and by technical service are contained in FM 101–10, part I. These data were compiled for specific theaters of operation and are based on previous combat experience and the latest information on supply requirements. See also paragraph 4.13.

4.10. Division Slice

In logistical planning, a preliminary estimate of the total size of a force is required to determine the final composition and the ultimate size of the force, since the required number of many service units, such as chemical decontamination and processing units, bears a direct relationship to the size force. The division slice includes the strength of an average combat division plus proportionate shares of the total corps, army, communications zone, and zone of interior personnel who are required to support one division. The total number of personnel in a theater division slice is 43,250. The division slice for any given force is equal to the total strength of the force divided by the number of combat divisions in the force. For a more complete discussion of division slices and chemical troop composition of a division slice, see FM 101–10, part I.

4.11. Basic Load for Chemical Corps Nontoxic Ammunition

A basic load of ammunition is that quantity of ammunition authorized to be carried by individuals and on the vehicles of a unit. Normally a unit's basic load will be sufficient to sustain that unit until resupply can be effected. A suggested basis of issue of Chemical Corps nontoxic ammunition for use in the determination of basic loads is provided in SB 3–39.

4.12. Day of Supply Data for Chemical Corps Ammunition

Day of supply data for Chemical Corps nontoxic ammunition may be found in SB 38–26. No day of supply data are presently available for toxic-filled Ordnance Corps ammunition or toxic-filled Chemical Corps ammunition.

4.13. Consumption of Chemical Class II and IV Supplies

To aid in estimating the tonnage of supplies needed to sustain combat forces, experience data have been compiled, based on the consumption of supplies during World War II and the Korean War. The tables below contain consumption data for chemical class II and IV supplies. *These figures are based on consumption under nonchemical and nonbiological operations.* In the absence of accurate experience data, consumption figures should be adjusted upward by a factor of 3 for predicting consumption under chemical and biological operations. Seven percent of chemical supply tonnage may be considered to be repair parts.

a. Chemical Class II and IV Consumption, Theater of Operations.

Theater and class of supply	Pounds per man per day	Tons per man per month	Conversion factor (short tons to measurement tons)[1]	Measurement tons per man per month
European:				.02
Class II	0.025	0.001	2.3	
Class IV	Negligible			
Pacific:				
Class II and IV	.567	.009	2.3	.02
Far East:				
Data not available				
Polar Regions:[2]				
Class II and IV	.030	Negligible	2.3	0.01

[1] Conversion factors are based on average cubage for each item. One measurement ton (mton) is 40 cubic feet.
[2] Estimated, based on arctic test operations.

b. Chemical Class II and IV Consumption, Combat Zone, Communications Zone, Army and Corps.

Pounds per man per day			Short tons per day	
Per Army man in combat zone, continental land mass [1]	Per Army man in combat zone jungle [2]	Per Army man in communications zone [3]	Per field army in combat [4]	Per corps in combat [5]
0.040	0.090	0.030	7.8	1.8

[1] Based on operations in Europe, all armies, 24 February 1945 to 28 March 1945.

[2] Based on Sixth and Eighth Army operations, December 1943 to September 1944.

[3] Assumed from theater averages, World War II.

[4] Computed for field army of 3 corps, each corps composed of 3 infantry and 1 armored division, and including necessary supporting and service elements (total strength, 392,000).

[5] Computed for corps of 3 infantry and 1 armored division with necessary supporting and service elements (total strength, 92,500).

c. Chemical Class II and IV Consumption, Combat Divisions.[1]

(1) *Airborne division.* The only data available pertair to an airborne division in airborne assault and indicate no consumption of chemical class II and IV supplies.

(2) *Armored division.*

Attack		Pursuit and exploitation		Defense		Reserve	
Pounds per man per day	Short tons per division per day	Pounds per man per day	Short tons per division per day	Pounds per man per day	Short tons per division per day	Pounds per man per day	Short tons per division per day
0.25	1.80	0.25	1.80	0.25	1.80	0.25	1.80

See footnote at end of tables.

(3) *Infantry division (offense).*

Attack of fortified position		Attack of deliberately organized position		Attack of hastily organized position		Pursuit		Attack of hostile shore	
Pounds per man per day	Short tons per division per day	Pounds per man per day	Short tons per division per day	Pounds per man per day	Short tons per division per day	Pounds per man per day	Short tons per division per day	Pounds per man per day	Short ton per divisions per day
0.251	1.70	0.252	1.70	0.051	0.40	0.091	0.60	0.191	1.30

(4) *Infantry division (defense).*

Covering, security force retirement of delaying action		Defense of position		Inactive situation		Reserve	
Pounds per man per day	Sbort tons per division per day	Pounds per man per day	Short tons per division per day	Pounds per man per day	Short tons per division per day	Pounds per man per day	Short tons per division per day
0.361	2.50	0.361	2.50	0.251	1.70	0.251	1.70

[1] Consumption is based on World War II data modified to reflect new organizations and strength. New organizations and changed tactical concepts may further modify these data.

4.14. Replacement Factors and Consumption Rates

a. Replacement Factor. A replacement factor is the estimated percentage of equipment in use that will require replacement during a given period because of wear out (beyond repair), enemy action, abandonment, pilferage, and other causes. The time period expressed in replacement factors listed in paragraphs 4.15 and 4.16 represents 1 month's replacement. The following are *not* considered in developing replacement factors:

(1) Obsolescence.
(2) Quantities for maintenance float.
(3) Replacement of unserviceable items being repaired or rebuilt for return to the supply system.
(4) Interdepot transfers.
(5) Ship sinkings.
(6) Issues in support of class IV projects.

b. Consumption Rate. Consumption rate is defined as the average quantity of an item expended or consumed during a given time interval, expressed in quantities per applicable basis. Typical bases of consumption rates are rounds per weapon per day, quantities per 1,000 individuals per month, and so forth.

c. Determination. Replacement factors and consumption rates are based on the latest available loss and consumption experience when these data are considered applicable. In the absence of valid loss and consumption experiences, factors are based on engineering estimates and experienced judgment after consideration of—

(1) New concepts of organization and operations.
(2) Latest techniques in maintenance.
(3) Technological advances.
(4) All other elements not excluded by *a* (1) through (6) above which affect the replacement of materiel.

d. Geographical Application.

(1) Peacetime factors and rates are applicable worldwide. When factors and rates are required for civilian components, Army Reserve, ROTC, and the National Guard, they will not exceed 25 percent of the peacetime factors and rates.
(2) The replacement factors and consumption rates presented in paragraphs 4.15, 4.16, and 4.17 are divided into two categories: worldwide peacetime, and wartime active and inactive rates. Wartime active rates and factors should be used in planning for operations under CBR conditions. Wartime inactive rates and factors should be used for planning support of operations under non-CBR conditions. Replacement factors and consumption rates provided in this manual should be used only in the absence of actual experience data. In any situation, when actual experience data are available, they should be used in lieu of factors and rates contained in this manual.

e. Sample Computations. Sample computations involving the use of replacement factors and consumption rates are shown below.

(1) *Replacement factor:*
Item—Protective mask
Conditions—Wartime active
Factor—0.0798 (from par. 4.15)
Mask density—400,000
$400{,}000 \times 0.0798 = 31{,}920$ masks (for 30-day period since factor is for 30 days)

(2) *Consumption rate:*
Item—Water testing kit, chemical agents
Conditions—Wartime active
Factor—3 kits per 1,000 indiv per month (from par. 4.17)
Personnel supported—100,000
$\frac{3 \times 100{,}000}{1{,}000} = 300$ kits

4.15. Replacement Factors for Chemical Corps Principal and Major Secondary Items

a. General. Replacement factors for principal and major secondary items of all technical services are published in SB 710–1. These items must meet an established criteria in order to be selected as principal or major secondary items and are funded by PEMA (Procurement of Equipment and Missiles, Army) appropria-

tions. Chemical Corps items of supply that meet the criteria for selection as PEMA items are listed in *b* below. In addition to replacement factors, the table also contains supply management data that will be helpful in chemical logistics planning. Chemical supply manuals and technical manuals should be consulted for additional and more up-to-date data.

b. Replacement Factors for Chemical Corps Principal and Major Secondary Items (PEMA).

Item	FSC Class	Replacement factors			Unit of issue	Packaging data							Limited storage [1]
		Peacetime worldwide	Wartime			Units per package	Type package	Gross weight (lb)	Cubage (cu ft)	Length	Width	Height	
			CONUS	Active						(in.)			
Decontaminating apparatus, power-driven, trailer-mtd, 200-gal., M8A2.	4230	0.0104	0.0116	0.0225	Ea	------	None	2,600	342.59	125	64	74	S
Decontaminating apparatus, power-driven, truck-mtd, 400-gal.,[2]	4230	.0104	.0116	.0225									
M3A2	------	------	------	------	Ea	------	None	11,090	1,240	252.5	87	98	S
M3A3	------	------	------	------	Ea	------	None	14,700	1,379.3	261	87	105	S
M9	------	------	------	------	Ea	------	None	16,775	1,379.3	261	87	105	S
Detonating equipment, war gas identification, M1.[3]	6910	.0136	.0136	------	Ea	1	Box	77	3.0	22 9/16	13 1/2	13 1/2	W
Filter unit, gas-particulate, GED, EMD,	4240	.0083	.0083	.0225									
300 CFM, ABC–M6	------	------	------	------	Ea	1	Crate	705	37.1	34	24	39	S
600 CFM, M9	------	------	------	------	Ea	1	Crate	830	57	30	40	81	S
600 CFM, M9A1	------	------	------	------	Ea	1	Crate	1,200	71.3	103	30	40	S
1,200 CFM, M10 (GED)	------	------	------	------	Ea	1	Crate	1,840	132	136	30	40	S
1,200 CFM, M10A1 (EMD)	------	------	------	------	Ea	1	Crate	1,900	132	------	------	------	S
2,500 CFM, M11 (EMD)	------	------	------	------	Ea	1	Crate	2,950	188	163	40	52	S
2,500 CFM, M11 (GED)	------	------	------	------	Ea	1	Crate	2,400	253.9	138	53	60	S
5,000 CFM, M12 (EMD)	------	------	------	------	Ea	1	Crate	4,165	290.7	158	53	60	S
5,000 CFM, M12 (GED)	------	------	------	------	Ea	1	Crate	4,000	290.6	158	52	60	S
Filter unit, gas-particulate, hospital, six-man, 12 CFM, M7 or ABC–M7A1.	4240	.0133	.0133	.1497	Ea	1	Box	138	5.7	39	14 1/2	17 1/2	S
Filter unit, gas-particulate, tank, three-man, 12 CFM, M8A2.	4240	.0055	.0055	.0416	Ea	1	Box	53	1.6	15 1/3	14 1/3	14 1/3	S
Filter unit, gas-particulate, tank, four-man, 12 CFM, M8A3.	4240	.0055	.0055	.0416	Ea	1	Box	52	1.8	------	------	------	S
Filter unit, gas-particulate, tank, five-man, 20 CFM, M13.	4240	.0133	.0133	.0160	Ea	1	Box	100	4.0				
Flamethrower, mechanized, main armament, M7–6 or M7A1–6.	1040	.0104	.0125	.0417	Ea	------	------	24,000	2,200	Shipped on dolly-mtd shipping stand.			S
Flamethrower, portable	1040	.0110	.0125	.0417									
ABC–M9–7	------	------	------	------	Ea	1	Box	64	6.8	24 7/8	26 1/2	14	W
M2A1–7	------	------	------	------	Ea	1	Chest	108	8.2	33 3/4	22 7/8	18 5/8	W
Generator, smoke, mechanical, pulse jet, ABC–M3A3.	1040	.0104	.0104	.0503	Ea	1	Crate	243	19.8	51	23 1/2	28 1/2	O
Mask, protective, field [4]	4240	.0184	.0184	.0798									

M9					Ea	6	Box	55	3.3	26¾	17⅛	11⅞	W
M9A1					Ea	6	Box	56	3.3	26¾	17⅛	11⅞	W
M17 [5]					Ea	10	Box	58	4.1	27½	19⅛	13⅝	W
Mask, protective, tank [4]	4240	.0184	.0184	.0798									
M14, ABC-M14A1					Ea	6	Box	60	2.6				W
M14A2					Ea	10	Box	71	5.1	21¼	24⅛	17	W
Riot control agent disperser, skid-mtd, GED, 5,000 CFM, M2.	1040	.0083	.0119	.0119	Ea	1	Crate	800	84.6	68⅝	43¼	47⅜	S
Service unit, flamethrower, truck-mtd [2]	1040	.0111	.0152	.0417									
M4					Ea		None	16,500	1,656				O
M4A1					Ea		None	16,500	1,656				O

[1] Limited storage is storage required for those supplies intended for withdrawal within 6 months, allowing for the least protected storage conditions authorized for specific items. The following code is used in this column: S=shed, O=open, W=warehouse.

[2] These items are mounted on truck, 2½-ton, 6 x 6, M45. Packaging data include vehicle weight and dimensions.

[3] Training item.

[4] See paragraph 4.26 for tariff sizes.

[5] Masks are shipped packed in fiberboard box within wooden box. Fiberboard box is 26¾ x 17⅛ x 11⅞ inches and weighs 44 pounds (10 masks per box).

4.16. Replacement Factors for Selected Minor Secondary Chemical Class II and IV Items of Supply

a. General. The table in *b* below contains replacement factors for certain chemical class II and IV items. The items for which replacement factors have been developed are items that are active during peacetime and become increasingly active during wartime. This table also contains supply management data that are helpful to the chemical logistics planner. Current supply manuals and technical manuals should be consulted for more complete and more recent data.

b. Replacement Factors and Supply Management Data for Selected Minor Secondary Chemical Class II and IV Items of Supply.

Item	FSC class	Replacement factors			Unit of issue	Packaging data							Limited storage [a]
		Peacetime worldwide	Wartime			Units per package	Type package	Gross weight (lb)	Cubage (cu ft)	Length	Width	Height	
			Inactive	Active						(in.)			
Adapter, compressed air breathing apparatus, M4.	4240	0.0166	0.0166	0.0277	Ea	2	Box	190	7.8	28	22	22	S
Adapter, line filling, one-ton container, M1.	4730	.0072	.0123	.0250	Ea	8	Box	104	2.2	21	15	12	O
Analyzing kit, chemical agent, M10A1.	6665	.0166	.0166	.0501	Ea	1	Box	45	2.4	30	17	8	S
Analyzing kit, impregnite, M26.	6665	.0236	.0236	.1490	Ea	1	Box	33	1.3	[b] 17½	[b] 14	[b] 10	S
Apparatus, filling, field, landmine, M2.	1040	.0076	.0076	.0117	Ea	1	Box	198	8.0	31	27¾	16	O
Beam, hoisting, liquid gas tank, M1.	1730	.0075	.0075	.0093	Ea	1	Wooden box.	192	3.2	84½	6½	10	O
Breathing apparatus, compressed air.	4240	.0192	.0192	.0221									
M15					Ea	1	Box	29	1.9	30	14	8	W
ABC–M15A1					Ea	1	Fiber box.	31	1.9	30	14	8	W
M23 (commercial item)					Ea	1	Carton	50	1.9	30	14	8	W
Breathing apparatus, oxygen generating.	4240	.0199	.0199	.0597									
M13					Ea	1	Case	40	2.2	23	18	9	W
M20					Ea	1	Carton	42	2.3	8½	18	23	W
Calculator, downwind toxic vapor hazard, point source, M2.	6665	.0083	.0083	.0083	Ea						Under procurement.		
Calculator, radiac, M1 [c]	6665	.0083	.0083	.0083	Ea	50	Carton	12.5	0.5				
Calculator set, nuclear, M28	6665	.0083	.0083	.0083	Ea						Under procurement.		W
Calibrator, radiac, TS–1230–( )/PD.	6665	.0120	.0180	.0300	Ea	[b] 25	Metal box	35	0.2	9	7	7	S
Canister, mask, protective, field, M11.	4240	.0200	.0400	1.000	Ea	18	Box	29	1.5	[b] 41	[b] 6½	[b] 5½	W

Comparator, color, hydrogen ion and residual chlorine, commercial, M2.	6630	.0208	.0208	.0416	Ea	1	Moisture vapor-proof bag.	4.7	0.12	9¼	5	4½	W
Decontaminating apparatus, portable, 1½-qt.	4230	.0083	----	.0166									
M2	----	----	----	----	Ea	6	Box	50	1.7	22	13	10	O
ABC-M11	----	----	----	----	Ea	12	Fiber box.	61	1.9	22	15	10	O
Dectector kit, carbon monoxide, colorimetric, M23.	6665	.0166	.0166	.0277	Ea	11	Box	18	1.7	16	13	10	S
Detector kit, chemical agent	6665	.0190	.0236	.0675									
M18	----	----	----	----	Ea	8	Box	43	1.8	30	15	7	S
ABC-M18A1	----	----	----	----	Ea	10	Carton	30	1.7	22	13	10	S
Detector kit, chemical agent, VGH, AN-M15A1 or AN-M15A1A.	6665	.0555	.0555	.1350	Ea	30	Box	48	2.3	23	18	9	S
Filter element, M13, 1 right and 1 left.[d]	4240	.0600	.1200	1.000	Set	10	Box	5	.84	22¼	8¾	7⅜	W
Heater, water, oil, skid-mounted, 600 GPH, M2.	4520	.0055	.0055	.0187	Ea	1	Crate	950	13.6	49	15	32	S
Hoisting unit, tripod, drum, M1	3950	.0048	.0118	.0278	Ea	1	Box	188	9.4	139½	12	10½	O
Indicator, combustible gas, portable, commercial, M6.	6665	.0139	.0416	.0416	Ea	1	Carton	10	0.25	8	7½	3½	W
Indicator, eyepiece leakage, M2	6665	.0055	.0055	.0165	Ea	1	Box w/skid.	225	17.0	41½	28	23¾	W
Indicator, outlet valve leakage, M4A1.	6665	.0055	.0055	.0165	Ea	1	Box	120	7.2	[b] 26	[b] 22	[b] 22	W
Mask, antiflash, rocket launcher, M19.	4240	.0420	.0420	.0830	Ea	100	Box	100	[b] 2.2	[b] 21	[b] 15	[b] 12	S
Mask, gas, acid and organic vapors, M10.	4240	.0219	.0219	.0753	Ea	1	Box	10	.7	14	13	7	S
Mask, gas, all-purpose, M11A1	4240	.0219	.0219	.0753	Ea	6	Box	74	4.4	29	17	15	S
Mask, gas, ammonia, M12	4240	.0219	.0219	.0753	Ea	6	Box	74	4.4	29	17	15	S
Mask, gas, dog, M6-12-8	4240	.0171	.0184	.0798	Ea	12	Box	51	3.9	28	16	15	S
Mask, gas, rocket propellant, ABC-M21.	4240	.0167	.0184	.0208	Ea	6	Box	96	4.1	[b] 30	[b] 17	[b] 15	S
Mask, protective, headwound, ABC-M18.	4240	.0034	.0050	.0798	Ea	10	Box	40	2.7	[b] 24	[b] 19	[b] 11	S
Mechanism, valve replacement, M1.	4940	.0046	.0070	.0070	Ea	1	Chest	375	13.7	39	38	16	S
Mount, fog oil drum, M3	1040	.0069	.0069	.0278	Ea	1	Box	50	1.0	41	7	6	S
Mount, smoke generator, M2 [e]	1040	.0069	.0069	.0278	Ea	1	Box	38	[b] .85	[b] 40	[b] 5	[b] 5	S
Respirator, air filtering, dust, ABC-M4.	4240	.0147	.0504	.0644	Ea	90	Box	29	1.6	41	6½	5½	S

See footnotes at end of table.

b. Replacement Factors and Supply Management Data for Selected Minor Secondary Chemical Class II and IV Items of Supply—Continued

Item	FSC class	Replacement factors			Unit of issue	Packaging data							Limited storage [a]
		Peacetime worldwide	Wartime			Units per package	Type package	Gross weight (lb)	Cubage (cu ft)	Length	Width	Height	
			Inactive	Active						(in.)			
Respirator, air filtering, paint spray, M5.	4240	.0298	.0298	.0298	Ea	12	Box	70	3.8	31	14	15	S
Sampling kit, chemical agent, M12.	6665	.0166	.0166	.0501	Ea	1	Box	43	2.3	20⅛	18	11	S
Service kit, portable flamethrower—riot control agent disperser, M27.	1040	.0095	.0167	.0278	Ea	1	Chest	115	8.6	34	23	19	O
Testing kit, impregnite-in-cloth-ing ABC–M2.	6630	.0236	.0236	.1490	Ea	60	Carton	23	1.0	17½	13½	7¼	W
Vulcanizer, hot patch, protective mask faceblank, M1.	4240	.0055	.0055	.0165	Ea	1	Box	56	2.8	[b] 24	[b] 19	[b] 11	W
Water testing kit, poisons, M4A1	6665	.0111	.0111	.0501	Ea	1	Box	45	2.3	31½	19½	6½	S
Winterizing kit, protective mask, M1.	4240	.0184	.0184	.0798	Ea	72	Box	79.5	3.2	[b] 84½	[b] 6½	[b] 10	W
Wrench, valve-removing, M1 and M2.	5120	.0091	.0091	.0278	Ea	5	Box	52	.9	31	7	7	S

[a] Limited storage is storage required for those supplies intended for withdrawal within 6 months, allowing for the least protected storage conditions authorized for specific items. The following code is used in this column: S=shed, O=open, W=warehouse.

[b] Estimated.

[c] Component of M28 nuclear calculator set.

[d] Component of M17 protective mask.

[e] Component of ABC–M8A3 mechanical smoke generator.

4.17. Consumption Rates for Selected Minor Secondary Chemical Class II and IV Items of Supply

a. General. Normally consumption rates are applied to expendable items that are consumable. The table in *b* below lists consumption rates for selected items. Allowances and basis of issue for most of the items listed below may be found in TA 3–104.

b. Consumption Rates and Supply Management Data for Selected Minor Secondary Chemical Class II and IV Items of Supply.

Item	FSC Class	Program basis	Consumption rates			Unit of issue	Packaging data					Ltd. storage [1]
			Peacetime worldwide	Wartime			Units per package	Type package	Gross weight (lb)	Cubage (cu ft)	Net quantity per package	
				Inactive	Active							
Antiset, decontaminating slurry, M2	6850	Lb/1000, indiv/mo.	0.08	0.14	0.78	Can	4	Box	54	1.3	50 lb	S
Bag, waterproofing, protective mask, M1.	4240	Ea/1,000 indiv/mo.	6.25	6.25	6.25	Ea	250	Box	50	1.5	250	S
Chlorinated paraffin, technical, Type 1.	6810	Lb/1,000 indiv/mo.	1.46	4.35	472.90	Drum	1	Drum	550	11.7	458 lb	O
Cleaning compound, solvent, bore cleaner, PD126:												
1-gal. can	6850	Gal./1,000 indiv/mo.	2.20	8.81	4.40	Ea	6	Box	57	1.4	6 gal.	W
1-qt. can	6850	Qt/1,000 indiv/mo.	2.87	11.49	5.57	Ea	12	Box	26	.8	12 qt.	W
6-oz can	6850	Can/1,000 indiv/mo.	2.11	8.43	4.21	Ea	12/pkg, 6/pkg/box.	Wooden box.	30	.75	72 cans	W
2-oz can	6850	Can/1,000 indiv/mo.	15.13	60.53	30.26	Ea	120	Box	32	1.0	120 cans	W
Crayon, vesicant detector, M7 and M7A1 (can of 3).	6665	Can/1,000 indiv/mo.	1.15	5.02	7.20	Can	384	Box	35	.6	384	S
Cresylic acid	6810	Gal./lb thickener/mo.	Determine locally		.0125	Can	6	Box	60	2	1 gal.	S
DANC solution unit, 3-gal., M4	6850	Ea/1,000 indiv/mo.	.53	.62	7.15	Ea	1	Box	59	1.2	1	S
Decontaminating agent, biological, BPL.	6850	Gal./engr sprayer/mo.	1.46	2.72	14.60	Pail	6	Box	NA	NA	6 gal.	S
Decontaminating agent, DS2:												
5-gal.	6850	Drum/1,000 indiv/mo.	.27	.37	4.29	Drum	1	Drum	45	1.1	5 gal.	S
1⅓-qt	-------	Ea/decon app 1½ qt/mo.	.03	.03	.29	Ea						
Decontaminating agent, STB	6850	Lb/1,000 indiv/mo.	26.36	45.00	256.63	Drum	1	Drum	61	1.4	50 lb.	S

See footnotes at end of table.

b. Consumption Rates and Supply Management Data for Selected Minor Secondary Chemical Class II and IV Items of Supply—Continued

Item	FSC Class	Program basis	Consumption rates			Unit of issue	Packaging data					Ltd. storage [1]
			Peacetime worldwide	Wartime			Units per package	Type package	Gross weight (lb)	Cubage (cu ft)	Net quantity per package	
				Inactive	Active							
Dye mix, olive drab	6820	Lb/1,000 indiv/mo.	.04	.11	11.75	Drum	1	Drum	131	5.4	100 lb	O
Food testing and screening kit, chemical agents, ABC–M3.	6665	Ea/1,000 indiv/mo.	.01	.03	3.00	Ea	24	Box	45	.8	24	S
Impregnating set, clothing, field, M3	4230	Ea/1,000 indiv/mo.	.10	.10	[2]( )	Ea	1	Box	53	1.7	1	S
Impregnating outfit, clothing, field	4230	Ea/1,000 indiv/mo.	.10	.10	[2]( )	Ea	1	Box	72	2.9	1	O
Impregnite, XXCC3	6850	Lb/1,000 indiv/mo.	2.15	6.44	700.00	Drum	1	Drum	86	2.7	75 lb	S
Insect repellent, clothing application, 1-gal. bottle.	6840	Bottle/1,000 indiv/mo.				Ea	12	Box	64	4.8	12 bottles	W
		(Japan)	.54	.54	.54							
		(Overseas other than Japan)	.60	.60	.60							
		(CONUS)	.18	.18	.18							
Insect repellent, personal application, 2-oz. bottle.	6840	Bottle/1,000 indiv/mo.				Ea	120	Box	32	1.0	120 bottles	W
		(Southeast Asia).	4000.00	4000.00	4000.00							
		(Central & South America).	250.00	250.00	250.00							
		(North America, Other Temperate Zones).	50.00	50.00	50.00							
Paper, liquid vesicant detector, M6 and M6A1.	6665	Book/1,000 indiv/mo.	.75	.91	5.00	Book	100	Box	45	1.0	100	S
Polyvinyl alcohol, technical, 100-lb drum.	6810	Lb/1,000 indiv/mo.	.10	.29	31.50	Drum	1	Drum	120	3.3	100 lb	S
Protection and treatment set, chemical agents, M5A1 and M5A3.	6505	Ea/1,000 indiv/mo.	2.05	2.59	250.00	Ea	70	Box	50	1.4	70	S
Vesicant agent protective ointment, M5.	6850	Ea/1,000 indiv/mo.	4.11	6.25	NA	Tube	144	Box	15	.3	144	S
						Tube	576	Box	75	1.8	576	S
Water testing kit, chemical agents, AN–M2.	6665	Ea/1,000 indiv/mo.	.01	.03	3.00	Ea	24	Box	50	1.0	24	S

[1] Limited storage is storage required for those supplies intended for withdrawal within 6 months, allowing for the least protected storage conditions authorized for specific items. The following code is used in this column: S=shed, O=open, W=warehouse.

[2] Class IV initial issue only.

4.18. Class V Chemical Supplies

a. General. Logistical data pertaining to Chemical Corps class V supplies which are classified as standard A or standard B is contained in *b* below. (See AR 705–6 for definitions of standards.) Only items handled through Chemical Corps supply channels are listed. See SB 38–26 for day of supply data for Chemical Corps nontoxic ammunition. Chemical munitions for USAF and U.S. Navy may be found in paragraph 3.17 of this manual. When stored for limited periods (6 months or less), all items listed require shed storage except chloroacetophenone solutions CNB and CNC, which may be stored in the open. Additional data required for requisitioning items listed in *b* below may be found in SM 3–1–1300.

b. Logistical Data for Chemical Corps Class V Supplies.

Item	Unit of issue	Units per container	Type container	Gross weight (lb)	Cubage (cu ft)	Package dimensions (in.)			Number as packed per 2½-ton truck
						Length	Width	Height	
Burster, incendiary, M4 steel, 12¼ in. long, 1¾ in. diam.	Ea	20	Fiber carton	50	.8	12	9¾	13½	2,000
Cryptographic equipment destroyer, incendiary, TH1, M1A1.	Ea	1	Fiber box	55	1.1	28½	19½	3	90
Cryptographic equipment destroyer, incendiary, TH1, M1A2.	Ea	1	Fiber box	55	1.1	28½	19½	3	90
Cryptographic equipment destroyer, incendiary, TH1, M2A1.	Ea	2	Wooden box	33	.8	21	10	6⅛	302
Cryptographic equipment destroyer, incendiary, TH4, M1A2.	Ea	1	Fiber box	55	1.1	28½	19½	3	90
Document destroyer, emergency, incendiary, M3.	Ea	1	Fiber drum	117	3.5	16	16	23¼	42
Document destroyer, emergency, incendiary, M3, w/o igniter.	Ea	1	Fiber drum	117	3.5	16	16	23¼	42
File destroyer, incendiary, ABC–M4	Ea	1	Wooden box	160	4.1	32	18¼	12¼	31
Grenade, hand, HC, AN–M8 smoke, w/fuze M201A1.	Ea	16	Box	41	.8	14	12½	8	1,936
Grenade, hand and rifle, WP, M34 smoke type, w/M206A2 fuze.	Ea	16	Box	42	.7	14	12¾	8	1,804
Grenade, hand, M18, green smoke, w/fuze M201A1.	Ea	16	Box	34	.8	14	12½	8	2,352
Grenade, hand, M18, red smoke, w/fuze M201A1.	Ea	16	Wooden box	34	.8	14	12½	8	2,352
Grenade, hand, M18, violet smoke, w/fuze M201A1.	Ea	16	Box	34	.8	14	12½	8	2,352
Grenade, hand, M18, yellow smoke, w/fuze M201A1.	Ea	16	Box	34	.8	14	12½	8	2,352
Grenade, hand, riot, CN, M7, w/fuze M201A1.	Ea	16	Box	33	.8	14	12½	8	2,416
Grenade, hand, riot, CN, M7A1, w/fuze M201A1.	Ea	16	Box	35	.8	14	12½	8	2,272
Grenade, hand, riot, CN1, ABC–M25A1, w/fuze C12.	Ea	50	Box	60	2.0	20⅞	18⅞	8¾	4,150
Grenade, hand, riot, CN1, ABC–M25A2, burning action, w/fuze C12.	Ea	50	Box	50	1.8	20⅛	18⅜	8¼	5,000
Grenade, hand, riot, CN–DM, M6, w/fuze M201A1.	Ea	16	Box	33	.8	14	12½	8	2,416
Grenade, hand, riot, CN–DM, M6A1, w/fuze M201A1.	Ea	16	Box	37	.8	14	12½	8	2,160
Grenade, hand, riot, CS, M7A1	Ea	16	Box	30	.9	14	12½	8	2,656
Grenade, hand, riot, CS, M7A2	Ea	16	Box	30	.9	14	12½	8	2,656
Grenade, hand, riot, CS1, M25A2	Ea	50	Box	50	1.8	17⅝	17⅝	7½	5,000
Grenade, hand, riot, DM1, ABC–M25A2, bursting action, w/fuze C12.	Ea	50	Box	50	1.8	17⅝	17⅝	7½	5,000

b. Logistical Data for Chemical Corps Class V Supplies—Continued

Item	Unit of issue	Units per container	Type container	Gross weight (lb)	Cubage (cu ft)	Package dimensions (in.)			Number as packed per 2½-ton truck
						Length	Width	Height	
Grenade, hand, TH3, AN–M14 incendiary, w/fuze M201A1.	Ea	16	Box	47	.8	14	12½	8	1,696
Ignition cylinder, flamethrower, M1.	Ea	100	Wooden box	54	1.2	16	14¼	9½	9,000
Mine, gas, persistent VX, 2-gal., ABC–M23.	Ea	3	Steel drum	115	3.8	17⅜	17⅜	21⅞	129
Mine, land, chemical, 1-gal. cap., empty.	Ea	10	Fiber container.	15	2.0	22½	14	11	2,000
Riot control agent, chloroacetophenone, CN1, 12 bags, 20 lb per bag in a 55-gal. drum.	Lb	240	Drum	300	11.7	35½	25	25	3,840
Riot control agent, chloroacetophenone solution, CNB.	Lb	1	Cylinder	15	.29	17½	5⅜	5⅜	333
	Lb	445	Drum	555	13.1	35½	25	25	4,005
Riot control agent, chloroacetophenone solution, CNC.	Lb	583	Drum	693	13.1	35½	25	25	4,081
Riot control agent, o-chlorobenzalmalononitrile, CS, 20-lb drum.	Drum	1	Drum	26	1.2	9⅜	9⅜	14½	192
Riot control agent, o-chlorobenzalmalononitrile, CS1, 10 bags, 8 lb/bag, in a 55-gal. drum.	Drum	1	Drum	140	11.7	35½	25	25	16
Riot control agent, o-chlorobenzalmalononitrile, CS capsule, 50 per can.	Can	100	Box	100	2.0	31½	17	4½	5,000
Rocket, gas, nonpersistent GB, 115-mm, M55, type T238.	Ea	15	Crate	1,400	40.3	83	30	28	45
Rocket, gas, persistent VX, M55, 115-mm, M55, type T238.	Ea	15	Crate	1,400	40.3	83	30	28	45
Smoke pot, floating, HC, M4A2, 10 min to 15 min max burning time, w/live igniting device.	Ea	1	Steel drum	48	1.72	15½	15	15	104
Smoke pot, floating type, w/fuel and smoke mixture, SGF2, AN–M7, w/live igniting device.	Ea	1	Shipped w/o packing.	37	1.5	12½	12½	13¾	135
Smoke pot, HC, M1 ground type, 5 min to 8 min max burning time, w/live igniting device.	Ea	3	Wooden box	54	.9	20⅝	6⅞	10½	276
Smoke pot, HC, M5 ground type, 10 min to 20 min max burning time, w/live igniting device.	Ea	1	Wooden box	47	1.1	12⅞	10¾	11½	106
Starter, fire, NP3, M1 filled w/incendiary mixture.	Ea	216	Wooden box	40	1.6	16⅞	13⅜	11⅞	27,000
Starter, fire, NP3, M2 filled w/incendiary mixture.	Ea	500	Wooden box	35	1.12	21⅜	10½	8¼	71,000
Thickener, incendiary oil, M1, 5¼-lb can.	Can	6	Wooden box	52	2.1	20	18¼	9¾	576
Thickener, incendiary oil, M1, 15¾-lb drum.	Drum	1	Drum	21	1.1	12	12	13⅛	238
Thickener, incendiary oil, M1, 100-lb drum.	Drum	1	Drum	125	6.5	19½	19½	29¼	40
Thickener, incendiary oil, M4, 2-lb can.	Can	12	Wooden box	50	1.5	18¼	15¼	8¼	1,200
Thickener, incendiary oil, M4, 20 lb in a 5-gal. drum.	Drum	1	Drum	26	1.2	9⅜	9⅜	14½	192
Thickener, incendiary oil, M4, 4 bags, 25 lb/bag in a 30-gal. drum.	Drum	1	Drum	128	6.0	21	21	30	39
Warhead, 762-mm rocket, gas, nonpersistent GB, M79, w/o fuzing.	Ea	1	Crate	2,900	196	150	48	53	1

4.19. Planning Allowances for Selected Class II Chemical Items[1]

Item	Factor		Basis	Remarks
	Quantity	Unit		
Compressor, reciprocating, power-driven, 3½ CFM.[2]	2	Ea	Per inf battle group	WAB TOC, CONARC
	2	Ea	Per armd rifle bn	WAB TOC, CONARC
	2	Ea	Per abn battle group	WAB TOC, CONARC
	2	Ea	Per inf bn, mech inf bn, abn bn	WAB TOC, CONARC, ARADCOM
	1	Ea	Per unit with authorized riot control agent disperser, portable.	
Decontaminating apparatus, portable, 1½-qt.[2]	1	Ea	Per self-propelled tactical or combat vehicle, wheeled or tracked.	WAB TOC, CONARC, ARADCOM
Decontaminating apparatus, power-driven, truck-mounted.	3	Ea	Per armd div, ord bn	
	1	Ea	Per spt co, U.S. Army Missile Comd	
	3	Ea	Per mech div, maint bn.[3]	
	3	Ea	Per armd maint bn.[4]	
Detector kit, chemical agent:				
M18A1	1	Ea	Per unit hq of CmlC units only	WAB TOC, CONARC, ARADCOM
M18A1	1	Ea	Per cml staff section of div or higher hq.	WAB TOC, CONARC, ARADCOM
M15A1A	1	Ea	Per platoon or similar sized unit	WAB TOC, CONARC, ARADCOM
M15A1A	1	Ea	Per co, bn, battle group, or similar sized unit hq.	WAB TOC, CONARC, ARADCOM
Filter unit, gas-particulate, hospital, six-man .[2]	1	Ea	Per 100-patient general or station hospital.	WAB TOC, CONARC, ARADCOM
Filter unit, gas-particulate, tank, four-man .[2 5]	2	Ea	Per M48A1, M48A2, and M48A3 tanks including M67A1 flamethrower.	WAB TOC, CONARC, ARADCOM
	2	Ea	Per bridge launcher on M48A2 tank chassis.	WAB TOC, CONARC, ARADCOM
	1	Ea	Per M113 APC with M10–8 flamethrower.	WAB TOC, CONARC, ARADCOM
Filter unit, gas-particulate, tank, five-man .[2]	1	Ea	Per M60 tank	
	1	Ea	Per M88 recovery vehicle	
	1	Ea	Per bridge launcher, armd vehicle with M60 chassis (under development).	
	1	Ea	Per combat engr vehicle, full tracked, T118.	
Flamethrower, portable [2]	1	Ea	Per rifle platoon	WAB TOC, CONARC
Heater, water, oil	1	Ea	Per U.S. Army Missile Comd.	
Mask, protective, headwound .[2]	2	Ea	Per div hq and hq co, inf, abn, armd, mech div.	
	4	Ea	Per abn div arty	
	4	Ea	Per abn div cav sqdn	
	32	Ea	Per div med bn, inf, abn, armd, mech div.	
	24	Ea	Per div arty, inf, armd, mech div	
Mask, protective, tank [2 6]	2	Ea	Per M113 APC with M10–8 flamethrower.	WAB TOC, CONARC, ARADCOM
	2	Ea	Per bridge launcher on M48A2 tank chassis.	WAB TOC, CONARC, ARADCOM
	2	Ea	Per M88 tank recovery vehicle	WAB TOC, CONARC, ARADCOM
	2	Ea	Per combat engr vehicle, full-tracked, T118.	WAB TOC, CONARC, ARADCOM
	2	Ea	Per bridge launcher on M60 tank chassis.	WAB TOC, CONARC, ARADCOM

See footnotes at end of table.

4.19. Planning Allowances for Selected Class II Chemical Items[1]—Continued

Item	Factor		Basis	Remarks
	Quantity	Unit		
	4	Ea	Per M48A1, M48A2, and M48A3 tanks.	WAB TOC, CONARC, ARADCOM
	4	Ea	Per M60 tank	WAB TOC, CONARC, ARADCOM
Radioactive source set	1	Ea	Per inf, abn, armd, mech div	
Respirator, air filtering, paint spray .[7]	2	Ea	Per paint spray gun	
Riot control agent disperser, helicopter- or vehicle-mounted.	5	Ea	Per div avn co	
	5	Ea	Per avn GS co	
	6	Ea	Per air mbl co	
Riot control agent disperser, portable.	1	Ea	Per MP platoon. All MP units NOA except units organized under TOE 19–47E, TOE 19–237D, TOE 19–252D, TOE 19–256D, and TOE 19–500D can be auth more than 1.	
	3	Ea	Per oversea battle group NOA	
	17	Ea	Per Eighth U.S. Army NOA	
Sampling kit, chemical agent	1	Ea	Per div cml section	
	1	Ea	Per corps cml section	
	1	Ea	Per army cml section	
Service kit, portable flamethrower–riot control agent disperser.[2]	2	Ea	Per inf battle group	WAB TOC, CONARC
	2	Ea	Per armd rifle bn	WAB TOC, CONARC
	2	Ea	Per abn battle group	WAB TOC, CONARC
	2	Ea	Per inf bn, mech inf bn, abn bn	WAB TOC, CONARC
	1	Ea	Per compressor, 3½ CFM	

[1] Does not include equipment used only by chemical units. These allowances are not to be construed as authority for current issue.
[2] These items are being added to the appropriate TOE at the next revision.
[3] Proposed basis of issue, TOE 29–25E.
[4] Proposed basis of issue, TOE 29–35E.
[5] The three-man filter unit has the same basis of issue with the following exception: the three-man filter unit cannot be used with the M48A3 tank.
[6] The basis of issue for this item authorizes this mask for those individuals assigned to a combat vehicle equipped with a filter unit and not otherwise authorized the M17 mask.
[7] This item is being considered for inclusion in TA 20–11 rather than TOE.

4.20. Mobilization Planning Allowances for Nonexpendable Class IV Chemical Items[a]

Item	Factor		Basis
	Quantity	Unit	
Filter unit, gas-particulate, EMD or GED	[b] 50	Ea	Per theater division slice
			or
	[b] 200	Ea	Per theater corps slice.
Filter unit, gas-particulate, hospital, six-man	As required	Ea	Per Maxillo Facial Center or hospital specializing in treatment of head and neck wounds.
Flamethrower, mechanized, main armament	5	Ea	Per tank bn.
Service unit, flamethrower, truck-mounted	1	Ea	Per tank bn.
	2	Ea	Per inf battle group.
	1	Ea	Per armd rifle bn.
	2	Ea	Per abn battle group.
	2	Ea	Per inf bn, airborne bn.
	1	Ea	Per mech inf bn.

[a] These allowances are not to be construed as authority for current issue.
[b] CBR operations.

4.21. End Item Densities for Combat Divisions

Equipment	Total quantities per combat division			Remarks
	Infantry TOE 7D	Armored TOE 17D	Airborne TOE 57D	
Chemical				
Compressor, reciprocating, power-driven, 3½ CFM [1]	10	8	10	WAB TOC, CONARC
Decontaminating apparatus, portable, 1½-qt [1]	2,701	3,529	1,536	
Decontaminating apparatus, power-driven, truck-mounted.	----	3	----	
Detector kit, chemical agent	94	96	79	
Filter unit, gas-particulate, tank, four-man [1]	450	1,271	----	WAB TOC, CONARC, ARADCOM
Flamethrower, portable [1]	75	48	100	WAB TOC, CONARC
Mask, protective, tank [1]	897	2,536	----	WAB TOC, CONARC, ARADCOM
Radioactive source set	1	1	1	
Respirator, air filtering, paint spray	78	88	4	
Riot control agent disperser, helicopter- or vehicle-mounted.[1]	5	5	5	
Sampling kit, chemical agent	1	1	1	
Service kit, portable flamethrower—riot control agent disperser.[1]	10	8	10	WAB TOC, CONARC
Radiacs (Signal)				
Charger, radiac detector, PP–1578A/PD	268	292	124	
Radiacmeter, IM–93/UD	839	985	404	
Radiacmeter, IM–174/PD	338	444	84	
Radiac set, AN/PDR–53	1	1	----	
Radiac set, AN/PDR–27	26	27	28	
Radiac set, PAC–3G (Radiacmeter, AN/PDR–54)	2	----	----	

[1] Items do not presently appear in these TOE's. Since no further changes are contemplated for these "D" series TOE's, items will probably not appear in these TOE's.

4.22. End Item Densities for Road Divisions

Equipment (full strength)	Division base				Inf Bn TOE 7–15E	Tank Bn[5] TOE 17–35E	Mech Inf Bn[6] TOE 7–45E	Airborne Inf Bn TOE 7–35E	Airborne Div Tank Bn TOE 17–15E
	Inf Div [1] TOE 7E	Armored Div [2] TOE 17E	Mech Div [3] TOE 37E	Airborne Div [4] TOE 57E					
Chemical									
Compressor, reciprocating, power-driven, 3½ CFM.	1	1	1	1	2	----	2	2	
Decontaminating apparatus, portable 1½-qt.	1,249	867	867	1,199	121	180	166	129	170
Decontaminating apparatus, power-driven, truck-mounted.	----	3	3						
Detector kit, chemical agent	70	70	70	62	5	4	5	5	4
Filter unit, gas-particulate, tank, four-man.	113	232	232	----	----	149	82	----	133
Flamethrower, portable	----	----	----	----	9	----	9	9	
Goggles, industrial, ventilated, clear.	----	----	----	9					
Mask, protective, headwound	58	58	58	42					
Mask, protective, tank	224	418	418	----	----	301	167	----	273

See footnotes at end of table.

4.22. End Item Densities for Road Divisions—Continued

Equipment (full strength)	Division base				Inf Bn TOE 7–15E	Tank Bn[5] TOE 17–35E	Mech Inf Bn[6] TOE 7–45E	Airborne Inf Bn TOE 7–35E	Airborne Div Tank Bn TOE 17–15E
	Inf Div[1] TOE 7E	Armored Div[2] TOE 17E	Mech Div[3] TOE 37E	Airborne Div[4] TOE 57E					
Radioactive source set	1	1	1	1					
Respirator, air filtering, paint spray	68	82	82	64	2	4	4	2	4
Riot control agent disperser, portable.	4	4	4	3			12		
Riot control agent disperser, helicopter- or vehicle-mounted.	11	11	11	11					
Sampling kit, chemical agent	1	1	1	1					
Service kit, portable flamethrower—riot control agent disperser.					2		2	2	
Radiacs (Signal)									
Calibrator, radiac, TS–784/PD	1	1	1	1					
Charger, radiac detector, PP–1578A/PD.	153	153	153	142	15	15	15	15	15
Radiacmeter, IM–9/PD	19	19	19	9					
Radiacmeter, IM–93/UD	502	499	499	429	53	58	61	53	58
Radiacmeter, IM–174/PD	217	205	205	171	29	25	27	29	25
Radiac set, AN/PDR–53	1	1	1	1		1			1
Radiac set, AN/PDR–27J	28	25	31	29		1			1

[1] Type infantry division consists of 8 infantry battalions, 2 tank battalions, and an infantry division base.

[2] Type armored division consists of 5 mechanized infantry battalions, 6 tank battalions, and an armored division base.

[3] Type mechanized division consists of 7 mechanized infantry battalions, 3 tank battalions, and a mechanized division base.

[4] Type airborne division consists of 9 airborne infantry battalions, 1 airborne division tank battalion, and an airborne division base.

[5] Equipment authorization is the same when organic to infantry division, armored division, or mechanized division.

[6] Equipment authorization is the same when organic to armored division or mechanized division.

Section III. CLASS V BASIC LOAD FOR CHEMICAL UNITS

4.23. General

The tables below furnish, for planning purposes, Ordnance ammunition basic load data for chemical units. Paragraph 4.25 lists ammunition basic load data for chemical smoke generator units which are likely to become involved in direct combat with the enemy. Paragraph 4.24 is applicable to all other chemical TOE units and also to smoke generator units which are not likely to become involved in direct combat with enemy forces. The assignment of weapons to chemical units may be found in paragraph 2.8. The tables in paragraphs 4.24 and 4.25 do not include basic load data for Chemical Corps nontoxic ammunition. These data are published in SB 3–39.

4.24. Ammunition Supply Data—Chemical Units—Basic Load

Weapon	Rounds per weapon		Wieght per round (lb)
	Secure area	Area of guerrilla activity	
Carbine, cal .30	60	90	0.036
Gun, mach, cal .50, Brg, hv barrel, flex.	420	525	.390
Gun, mach, 7.62-mm, lt wt, general purpose.	1,760	2,200	.080
Gun, submach, cal .45	60	90	.057
Launcher, rocket, 3.5-in.	3	3	17.700
Pistol, auto, cal .45	21	21	.057
Rifle, auto-semiauto, 7.62-mm, selective, hv barrel.	260	500	.072
Rifle, semiauto, 7.62-mm, lt barrel.	100	160	.072
Rifle, U.S. cal .30	96	144	.095

4.25. Ammunition Supply Data—Chemical Smoke Units—Basic Load

Unit and type munition	Rd per wpn	Wt per rd (lb)	Total wpn	Total rd	Carried on individual		Carried on vehicle		Bulk loaded		Total wt (lb)
					Rd per wpn	Total wt (lb)	Rd per wpn	Total wt (lb)	Rd per wpn	Total wt (lb)	
HQ & HQ DET, CML SMOKE GENR BN (TOE 3-266E)											
Pistol, auto, cal .45	21	0.057	2	42	21	2.39	-----	-----	----	-----	2.39
Rifle, semiauto, 7.62-mm, lt barrel.	120	0.072	20	2,400	60	86.40	60	86.40	----	-----	172.8
											175.19 = 0.09 ton
CML SMOKE GENR CO (TOE 3-267E)											
Gun, mach, cal .50, Brg, hv barrel, flex.	530	0.390	3	1,590	-----	-----	530	620.10	----	-----	620.10
Gun, mach, 7.62-mm, lt wt, general purpose.	530	0.080	5	2,650	-----	-----	530	212	----	-----	212.00
Launcher, rocket, 3.5-in.	6	17.700	4	24	-----	-----	6	424.80	----	-----	424.80
Rifle, semiauto, 7.62-mm, lt barrel.	120	0.072	141	16,920	60	609.12	60	609.12	----	-----	1,218.24
Generator, smoke, mechanical, pulse-jet [a].	[b] 4	455.830	48	[b] 192	-----	-----	3	65,639.52	1	21,879.84	87,519.36
	[c] 3	25.000	48	[c] 144	-----	-----	1	1,200.00	2	2,400	3,600.00
											93,594.50 = 46.80 tons

[a] A single mechanical smoke generator operating at maximum capacity consumes approximately 1,200 gallons of fog oil per 24-hour day.
[b] Round is 55-gallon drum of fog oil.
[c] Round is 5-gallon can of 80-octane gas. TA 10-100 authorizes three 5-gallon cans per smoke generator.

Section IV. PROTECTION AND IDENTIFICATION EQUIPMENT

4.26. Breathing Apparatus, Protective Masks, and Respirators

Type of mask	Status	Logistical data				Use
		Units per container	Weight (packaged) (lb)	Volume of package (cu ft)	Sizes [a]	
Breathing apparatus, compressed air, M15.	Std C	1/box	29	1.0	(M)	Supplies respirable air to handlers of liquid guided missile fuels and oxidizers; also used in any atmosphere which is deficient in oxygen.
Breathing apparatus, compressed air, ABC-M15A1.	Std A	1/box	31	1.5	(M)	Same as for M15. M15A1 has an added alarm, a safety valve, and a mask winterizing kit.
Breathing apparatus, oxygen generating, M13.	Std B	1/case w/3 canisters.	40	2.2	(M)	Is used where there is a deficiency of oxygen or a high concentration of toxic vapors in the air.
Breathing apparatus, oxygen generating, M20.	Std A	1/carton	42	2.3	(M)	Same as for M13.
Mask, antiflash, rocket launcher, M19.	Std B	100/box	100	[b] 2.2	NA	Protects face and eyes of individual firing 3.5-in. rocket launcher.

See footnotes at end of table.

4.26. Breathing Apparatus, Protective Masks, and Respirators—Continued

Type of mask	Status	Logistical data				Use
		Units per container	Weight (packaged) (lb)	Volume of package (cu ft)	Sizes [a]	
Mask, gas, acid and organic vapors, M10.	Std A	6/box	74	4.4	(M)	Special-purpose mask. Protects against toxic acids and organic vapors with the exception of ammonia fumes and carbon monoxide.
Mask, gas, all-purpose, M11A1.	Std A	6/box	74	4.4	(M)	Protects against all poisonous gases, smoke, and fumes encountered in industry or in handling chemical agents.
Mask, gas, ammonia, M12.	Std A	6/box	74	4.4	(M)	Protects against ammonia gas only.
Mask, gas, dog, M6-12-8.	Std A	12/box	51	3.9	NA	Protects dogs against CBR agents.
Mask, gas, rocket propellant, ABC-M21.	Std A	6/box	96	4.1	(S)(M)(L)	Protects personnel handling liquid rocket propellant fuels against low concentration of vapors from the fuels.
Mask, protective, civilian, M22.	Std A (Civil Defense).	30/box	33	3.3	1, 2, 3, 4, 5, 6	Lightweight mask to protect civilians against CBR agents; standard civil defense mask; mask will fit any civilian except children under 4 years.
Mask, protective, field, M9 and M9A1.	Std B	6/box	56	3.3	(S)(M)(L) [c]	Protects face, eyes, and respiratory tract against CBR agents; only difference between models is difference in carriers.
Mask, protective, field, M17.	Std A	10/box	58 44	4.1 3.3	(S)(M)(L) [d]	Protects face, eyes, and respiratory tract against CBR agents.
Mask, protective, headwound, ABC-M18.	Std A	10/box	40	2.7	(U)	Protects face and respiratory tract of patients with head wounds against CBR agents during evacuation.
Mask, protective, noncombat, M16.	Std A (Civil Defense).	12/box	39	3.1	3, 4, 5, 6	Protects civil defense workers against CBR agents; sizes do not include children's masks.
Mask, protective, tank, M14.	Std C	6/box	60	2.6	(M)	Is used with 3-man M8A2 and 4-man M8A3 filter units for defense against CBR agents.
Mask, protective, tank, ABC-M14A1.	Std B	6/box	60	2.6	(S)(M)(L) [e]	Performance is same as for M14; differences between models are discussed in appropriate TM's.
Mask, protective, tank, M14A2.	Std A	10/box	71	5.1	(S)(M)(L) [e]	Performance is same as for ABC-M14A1; differences are improved nosecup to reduce fogging; provisions for attachment of eyelens inserts; special harness for canister to facilitate use without carrier.
Respirator, air filtering, dust, ABC-M4.	Std A	90/box	29	1.6	NA	Protects against nuisance dust; employs a pad type filter and has no outlet valve.
Respirator, air filtering, paint spray, M5.	Std B	12/box	70	4.1	NA	Protects against organic vapors, paint lacquer, and enamel mists.
Respirator, air filtering, paint spray, commercial, M6.	Std A	12/box	Commercial item, weight and volume unspecified.			Protects against organic vapors, paint lacquer, and enamel mists.

[a] Sizes are small (S), medium (M), large (L), and universal (U).
[b] Estimated.
[c] Tariff size: 26 percent small, 68 percent medium, 6 percent large.
92 percent left-cheek canisters, 8 percent right-cheek canisters.
[d] Tariff size: 11 percent small, 85 percent medium, 4 percent large.
[e] Tariff size: 26 percent small, 68 percent medium, 6 percent large.

4.27. Replacement of Protective Mask Canister and Filter Elements

a. To determine when to replace the canister of a field protective mask during CBR operations, credit the life of each canister with 100 units; subtract the appropriate number of units for each type of agent attack listed below; and replace the canister when the 100 units have been exhausted.

b. For determining when to replace the filter elements of an M17 protective mask during CBR operations, credit the total life of the filter elements with 50 units; subtract the appropriate number of units for each type of agent listed below; and replace the canister when the 50 units have been exhausted.

Type of agent attack	*Units to be subtracted per attack*
Ground-delivered nerve agent	½
Air-delivered nerve agent	1
Blister agent	1
[1] CK (30-sec to 2-min surprise attack)	10
All other agents, including unidentified ones	6

[1] If canister is exposed to heavy CK attack for a period of 15 to 60 minutes, replace canister without further use.

4.28. Protective Clothing

There are two general types of protective clothing, permeable and impermeable. Permeable protective clothing is also known as impregnated clothing. Protective clothing is a logistical responsibility of the Quartermaster Corps. (Exception is supplied-air impermeable suits which are a Chemical Corps responsibility.) The Chemical Corps provides technical assistance to the Quartermaster Corps in the development of protective clothing. Impregnation of permeable clothing is a responsibility of the Chemical Corps and is accomplished by the chemical processing company.

a. Permeable Protective Clothing. Permeable clothing is worn by combat troops and service support troops during warfare under CBR conditions. Stocks of complete sets of permeable protective clothing will not be maintained in the hands of troops, except as required for training. Allowances of permeable (impregnated) clothing are prescribed in TA 21 (PEACE, MOB) and TA 20–11. Allowances vary, depending on the climatic zone where the clothing will be worn (AR 700–62). Items of permeable clothing are—

(1) Drawers, man's, cotton knit, ankle length.
(2) Undershirt, man's, cotton knit, full length sleeve.
(3) Shirt, man's, cotton sateen.
(4) Trousers, man's, cotton sateen.
(5) Gloves, cloth, work type, man's, cotton, knit cuff.
(6) Gloves, shell, leather.
(7) Hood, gas mask, toxicological agents, protective.
(8) Socks, man's, wool, black, w/cushion sole.
(9) Boots, combat.
(10) Flap, vesicant gas protective, man's shirt-jacket.
(11) Flap, vesicant gas protective, man's trousers.
(12) Coat, vesicant gas protective (cotton sheeting).
(13) Trousers, vesicant gas protective (cotton sheeting).

Each item of permeable clothing must be requisitioned separately. Stock numbers and complete nomenclatures of above items may be found in appropriate Quartermaster supply manuals.

b. Impermeable Clothing. Impermeable clothing is intended primarily for the protection of military personnel engaged in extremely hazardous decontamination work or in special operations involving danger from spillage or splashes in the handling of liquid chemical agents. Impermeable clothing is made of butyl-rubber-coated materials which resist penetration of liquid chemical agents and provide complete protection against biological agents, as well as protection against physical contact with radioactive dust. Allowances of impermeable clothing are contained in TA 21 (PEACE, MOB) and TA 20–11. The complete impermeable outfit consists of an inner layer of permeable clothing (*a* above) and an outer layer or shell of impermeable clothing. Items of impermeable clothing and equipment are—

(1) Coveralls, toxicological agents, protective.
(2) Hood, gas mask, toxicological agents, protective.

(3) Cover, boot, toxicological agents, protective.
(4) Gloves, toxicological agents, protective, synthetic rubber and nylon film.
(5) Boot, knee, man's, rubber; boot, insulated; or boot, combat.
(6) Suit, cooling, toxicological agents, protective coveralls.
(7) Cover, cooling, toxicological agents, protective gas mask hood.
(8) Apron, toxicological agents, protective.

Items (6), (7), and (8) are impermeable clothing accessories. Each item of impermeable clothing must be requisitioned separately. Stock numbers, complete nomenclature, and other data needed for requisitioning items of impermeable clothing may be found in the appropriate Quartermaster supply manual.

c. Impermeable Clothing Wearing Time. The table below shows maximum wearing time recommended for personnel engaged in moderate physical activity while wearing impermeable clothing without cooling suit and hood cover.

Temperature (°F.)	Wearing time (hr)
Above 90	¼
85 to 90	½
80 to 85	1
70 to 80	1½
60 to 70	2
50 to 60	3
30 to 50	5
Below 30	8

d. Reference. Stockage and issue policy, as well as guidance for determining items and quantities of protective equipment, may be found in AR 700–62.

4.29. Characteristics of Gas-Particulate Filter Units

Type	Status	Net weight (lb)	Packaging data					Purified air delivery (CFM)	Means of operation
			Weight (lb)	Length (in.)	Width (in.)	Height (in.)	Cuhage (cu ft)		
ABC–M6 GED	Std A	400	705	34	24	39	37.1	300	1½ HP gasoline engine, for outside installation; uses two M10 gas filters and two M9 particulate filters.
ABC–M6 EMD	Std A	400	705	34	24	39	37.1	300	1 HP electric motor, 110 volt, 60 cycle, 746 watts, for outside installation; uses two M10 gas filters and two M9 particulate filters.
M7, hospital, six-man	Std B	[a] 69	138	39	14½	17½	5.7	12	24 volt DC or 115 volt, 60 cycle AC, for inside installation.
ABC–M7A1, hospital, six-man.	Std A	[a] 69	138	39	14½	17½	5.7	12	24 volt DC or 115 volt, 60 cycle AC, for outside or inside installation; uses M13 particulate filter and M12A1 gas filter.
M8A2, tank, three-man	Std B	50	53	15⅓	14⅓	14⅓	1.6	12	24 volt AC or DC, for outside or inside installation; uses M2A1 gas filter and M13 particulate filter.
M8A3, tank, four-man	Std A	-------	52	-------	-------	-------	1.8	12	Same as M8A2 except permits four-man installation.
M9 GED	Std A [b]	600	830	81	30	40	57	600	1½ HP gasoline engine, for outside installation; uses M14 gas-particulate filter.
M9 EMD	Std C	800	1,200	103	30	40	71.5	600	1 HP electric motor, 230 volt, 60 cycle, 3 phase AC, for outside installation; uses M14 gas-particulate filter.

See footnotes at end of table.

4.29. Characteristics of Gas-Particulate Filter Units—Continued

Type	Status	Net weight (lb)	Packaging data					Purified air delivery (CFM)	Means of operation
			Weight (lb)	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)		
M9A1 EMD	Std A	800	1,200	88	33	45	75	600	1 HP electric motor, 230 volt, 60 cycle, 3 phase AC, for inside or outside installation; uses M14 gas-particulate filter.
M10 GED	Std A	1,000	1,840	136	30	40	132	1,200	2½ HP gasoline engine, for outside installation; uses M15 gas-particulate filter.
M10A1 EMD	Std A	1,200	1,840	116	33	45	93.9	1,200	2 HP electric motor, 230 volt, 60 cycle, 3 phase AC, for inside or outside installation; uses M15 gas-particulate filter.
M13, tank, five-man	Std A	-------	100	-------	-------	-------	4.0	20	24 volt AC or DC; supplements requirements for M8A2 filter unit; uses one M19 particulate filter and two M18 gas filters.
M11 GED	Std A	1,500	2,400	138	53	60	253.9	2,500	5.6 HP gasoline engine, for outside installation; uses M16 gas-particulate filter.
M11 EMD	Std A	1,700	2,950	163	40	52	190.6	2,500	5 HP electric motor, 230 volt, 3 phase AC, for outside installation; uses M16 gas-particulate filter.
M12 GED	Std A	2,600	4,000	158	53	60	290.7	5,000	10 HP gasoline engine for outside installation; uses M17 gas-particulate filter.
M12 EMD	Std A	2,800	4,165	158	52	60	285.2	5,000	7½ HP electric motor, 230 volt, 60 cycle, 3 phase AC, for outside installation; uses M17 gas-particulate filter.

[a] Approximate.
[b] Standard A, Navy.

4.30. Miscellaneous Protective Equipment

Item	Status	Logistical data			Use
		Units per container	Weight—packaged (lb)	Volume of package (cu ft)	
Bag, waterproofing, protective mask, M1.	Std A	250	50	1.5	Protects M9A1 mask immediately prior to amphibious operations.
Leather dressing, vesicant gas resistant.[1]	Std A	48	15 (4-oz cans)	.43	Retards passage of blister agents through leather.
Protection and treatment set, chemical agents, M5A3.	Std A	70	50	1.4	*Contents of set:* 3 tubes M5 protective ointment. 1 atropine syrette.
Vesicant agent protective ointment, M5.	Std A	576	75	1.8	Decontaminant for blister agent.
		144	15	.3	
Winterizing kit, protective mask, M1.	Std A	72	79½	3.2	Protects M9A1 mask in extreme cold.

[1] Item supplied by Corps of Engineers.

4.31. Detection and Identification Equipment

Item	Status	Logistical data			Use
		Units per container	Weight (packaged) (lb)	Volume of package (cu ft)	
Alarm, G-agent, automatic, fixed installation, M5.	Std A	4 boxes	Box 1— 90 2—1,030 3— 250 4— 480	11.0	Provides an automatic alarm system for detecting G-agents.
Analyzing kit, chemical agent, M10A1.	Std A	1/box	45	2.1	Identifies vapors of the following agents: G-series, CK, AC, CG, L, ED, H, HN, CN, BBC, and PS.
Calculator set, nuclear, M28 (w/calculator, radiac, ABC–M1, and calculator, nuclear yield M4).	Std A	100 sets/box	20	.87	Makes quick and accurate calculations of residual radiation in radioactive fallout areas.
Crayon, vesicant detector, M7.	Std B	3/can 128 cans/box.	35	.6	Detects liquid blister agents.
Crayon, vesicant detector, M7A1.	Std A	3/can 128 cans/box.	35	.6	Same as for M7 crayon.
Detector kit, chemical agent, M9A2.	Std B	8/box	50	2.1	Detects G-agents, CK, AC, CG, L, ED, H, HN; uses C9A2 refill kit.
Detector kit, chemical agent, VGH, AN–M15A1A.	Std A	30/box	48	2.3	Detects V-agents, G-agents, H, CK, and CX; uses C15R1 refill kit.
Detector kit, chemical agent, M18.	Std B	8/box	43	1.7	Detects vapors of AC, CG, CK, ED, G-agents, H, HN, and L.
Detector kit, chemical agent, ABC–M18A1.	Std A	10/carton	30	1.7	Same as for M18 except M18A1 may be used also to detect V-agents and CX.
Food testing and screening kit, chemical agents, ABC–M3.	Std A	24/box	45	.8	Detects contamination of food or food packages by chemical agents.
Paper, liquid vesicant detector, M6.	Std B	100 books/box	45	1.0	Detects presence of liquid blister agents and liquid G-agents.
Paper, liquid vesicant detector, M6A1.	Std A	100 books/box	45	1.0	Same as for M6 paper.
Sampling kit, chemical agent, M12.	Std A	1/box	43	2.3	Used in collecting samples of suspected persistent liquid or solid chemical agents from soil, vegetation, or food surfaces and preparing them for shipment to laboratories.
Water testing kit, chemical agents, AN–M2.	Std A	24/box	50	1.0	Detects contamination of unchlorinated water by chemical agent.
Water testing kit, poisons, M4A1.	Std A	1/box	45	2.3	The M4A1 poisons water-testing kit is used in conjunction with a water-testing and screening kit to measure the concentration of previously identified chemical agents in water; to determine the feasibility of treating the water; to determine the quality of chemicals needed for treatment; and to test whether the treatment has been successful.

Section V. CLASS III SMOKE AGENTS

4.32. Fog Oils

Fog oils SGF1 and SGF2 are class III smoke agents which are stored and issued by the Quartermaster Corps. SGF2 fog oil is used with the ABC–M3A3 smoke generator.

Nomenclature	QMC stock No.	Unit	Shipping container			
			Number of units	Type	Cubage (cu ft)	Gross weight (lb)
Oil, fog, SGF1[a]	9150–261–7897	Gal.	53	55-gal. drum (16-gage).	11.2	468
Oil, fog, SGF1[a]	9150–261–7898	Gal.	53	55-gal. drum (18-gage).	11.2	455
Oil, fog, SGF2	9150–261–7894	Gal.	53	55-gal. drum (16-gage)	11.2	461
Oil, fog, SGF2	9150–261–7895	Gal.	53	55-gal. drum (18-gage).	11.2	448

[a] Formerly used with M3A1 and M3A2 smoke generators which are obsolete.

Section VI. WATER SUPPLY

4.33. Water Requirements for Operations of Chemical Units

Water supply requirements for operations of chemical units under temperate climatic conditions are shown below. In hot climates, maximum requirements may exceed the given values by 15 to 100 percent.

Water consumer	Daily water consumption (gal.)	Remarks
Motor vehicle	⅛ to ½ (in level or rolling terrain).	Consumption varies with size of vehicle.
Motor vehicle	¼ to 1 (in mountainous terrain).	Consumption varies with size of vehicle.
Clothing impregnating plant	4,400	Includes 400 gal. for washing and cleaning purposes; 5 gal. distilled water also required daily for plant laboratory.
Power-driven, truck-mounted, 400-gal. decontaminating apparatus.	4,000	For decontamination purposes; apparatus normally filled from natural source.
Power-driven, truck-mounted, 400-gal. decontaminating apparatus.	4,000	For bathing purposes; apparatus normally filled from natural source.
Power-driven, trailer-mounted, 200-gal. decontaminating apparatus.	2,000	For decontamination purposes; apparatus normally filled from natural source.
Mobile laboratory, M3	215	Includes 15 gal. distilled water required daily.
Laboratory, M2 (theater)	325	Includes 25 gal. distilled water required daily.

4.34. Water Distribution and Storage Equipment of Chemical Units

Item	Capacity	No. per using unit full str (Reduced str)	Using unit (TOE)	No. per using unit full str (Reduced str)	Using unit (TOE)	No. per using unit full str (Reduced str)	Using unit (TOE)
Bag, water, sterilizing	36 gal.	8	3–7D	1	3–67D	1	3–147E.
		1	3–32E	1	3–77E	1	3–217E.
		1	3–36E	1	3–97D	1	3–267E.
		1	3–47E	1	3–117E		
Can, water	5 gal.	16	3–7D	8	3–217E	4 (3)	Team EA.
		10	3–32E	4	3–266E	10 (6)	Team EB.
		7	3–36E	9	3–267E	4 (2)	Team FA.
		7	3–47E	1(1)	Team AA	8 (8)	Team FB.
		28	3–67D	1 (1)	Team AB	2 (2)	Team GA.
		19	3–77E	1 (1)	Team AC	4 (4)	Team HA.
		10	3–97D	4 (2)	Team BA	2 (1)	Team IA.
		5	3–117E	7 (5)	Team BB	1 (1)	Team JA.
		9	3–147E				
Decontaminating apparatus, power-driven, truck-mounted.	400 gal.	5	3–147E	3 (1)	Team FA	6 (6)	Team FB.
		12	3–217E				
Decontaminating apparatus, power-driven, trailer-mounted.	200 gal.	12	3–7D				
Heater, immersion type, for corrugated can.		9	3–7D	6	3–77E	8	3–217E.
		6	3–47E	4	3–117E	6	3-267E.
		6	3–67D	8	3–147E		
Heater, water, immersion type, gasoline-operated.		1	3–7D	1	3–217E	1 (1)	Team AB.
		1	3–67D	1	3–147E	1 (1)	Team AC.
		1	3–117E	3	3–267E		
Heater, water, oil		5	3–147E	6	3–217E		
Hose, cotton, rubber-lined, 1½ in. by 25 ft (fire).		4	3–77E	2 (2)	Team FA	4 (4)	Team FB.
		6	3–217E				
Hose, suction, water, 2 in. by 10 ft.		10	3–77E				
Hose, suction, water, 2 in. by 20 ft.		15	3–217E				
Hose, suction, water, 1½ in. by 10 ft.		5 (5)	Team FA	10 (10)	Team FB	10	Team FC.
Hose, water, ¾ in. by 50 ft		6	3–77E				
Pump, centrifugal, gasoline-driven.	55 GPM	2	3–77E	3	3–217E		
Pump, centrifugal, gasoline-driven.	166 GPM	1 (1)	Team FA	2 (2)	Team FB	1	3–147E.
Tank, fabric, 3,000-gal.	3,000 gal.	2	3–77E	3	3–217E	2 (2)	Team FB.
		1	3–147E	1 (1)	Team FA		
Trailer, 1½-ton, water tank, 2-wheel.	400 gal.	1	3–7D	1	3–117E	3	3–267E.
		1	3–47E	1	3–147E	1 (1)	Team AB.
		1	3–67D	1	3–217E	1 (1)	Team AC.
Water purification equipment, set No. 2.	900 GPH	1	3–97D				

Section VII. STORAGE AND HANDLING OF SUPPLIES

4.35. Storage of Supplies

Information pertaining to the storage of Chemical Corps supplies, equipment, and ammunition and chemical-filled ammunition may be found in TM 3–250, TM 3–300, TM 3–400, TM 9–1900, TM 743–200, SB 3–24, and SB 38–8–1.

4.36. Storage Area Factors

Planning factors to estimate space requirements for storage of chemical supplies are given in FM 101–10, part I.

4.37. Handling of Supplies

Planning data for estimating time and labor required to handle supplies may be found in FM 101–10, part I. Data in FM 101–10, part I, are based on average time and labor required to load and unload supplies.

4.38. Materials Handling Equipment

a. General. Quartermaster materials handling equipment issued to chemical units is listed in paragraph 2.8. For more complete information pertaining to the dimensions, weight, capacity, and characteristics of quartermaster materials handling equipment, see TM 10–1619.

b. Chemical Filling and Handling Equipment. For information on chemical filling and handling equipment, see TM 3–255.

4.39. Stowage Factors

a. Computation. The stowage factor is the number of cubic feet required to store one long ton (2,240 lb) of cargo. While by definition stowage factors pertain to long tons, stowage factors may be derived for short tons (*c* below).

Storage space required (cu ft) = stowage factor × number of tons.

b. Short Ton—Volume Ratios. Weight-volume ratios are based on the average cubage for each item. The measurement tonnage for any item can be found by multiplying its short ton weight by its conversion factor. One measurement ton is equal to 40 cubic feet.

c. Stowage Requirements. The data below indicate factors that can be used to estimate stowage requirements for chemical supplies when cargo weight is in short or long tons.

Item	*Conversion factor (short ton to measurement ton)*	*Stowage factor for long tons*	*Stowage factor for short tons*
Class II and IV	2.3	103 cu ft	92 cu ft.
Class V	1.2	54 cu ft	48.2 cu ft.

4.40. Characteristics of 1-Ton Containers and 55-Gallon Drums[1]

Type	Weight (empty) (lb)	Capacity (gal.)	Cubage (cu ft)	Filling
A, 1-ton	1,600	170	42.7	Chlorine. Blood agents. Choking agents.
D, 1-ton	1,600	170	42.7	Blister agents. Nerve agents. Choking agents. Blood agents. Chlorine.
A, 55-gal.[2]	110	55	13.7	Liquid FS, FM, and MR.
B, 55-gal.[2]	110	55	13.7	Liquid FS, FM, and MR.

[1] Containers listed in this paragraph are not standard and will not be type classified, since the requirement for these items is limited.
[2] These containers have attached rolling hoops.

4.41. Chemical Agents in 1-Ton Containers

Chemical agent		Container	
Nomenclature, symbol	Pounds per 1-ton container	Type	Gross weight (lb)
Chlorine, Cl	1,855	A or D	3,455
Cyanogen chloride, CK	1,600	A or D	3,200
GB	1,500	D	3,100
Mustard, H	1,900	D	3,500
Mustard, distilled, HD	1,800	D	3,400
Mustard-T-mixture, HT	1,800	D	3,400
Phosgene, CG	1,600	A or D	3,200
VX	1,600	D	3,200

Section VIII. MAINTENANCE

4.42. References

Number	Title
AR 711–16	Installation Stock Control and Supply Procedures.
AR 750–1	Concept of Maintenance.
AR 750–5	Organization, Policies, and Responsibilities for Maintenance Operations.
AR 750–50	Use of Controlled Cannibalization as a Source of Low Mortality Repair Parts Supply.
AR 750–312	Chemical Corps Technical Assistance Program.
AR 750–314	Maintenance Expenditure Limitations, Chemical Corps Equipment.
AR 750–370	Chemical Field Maintenance Shops and Mission.
AR 780–370	Depot Missions, Chemical Corps.
DA Pam 750–1	Preventive Maintenance Guide for Commanders.
FM 3–85	Chemical Service Units.
FM 38–1	Logistics Supply Management.
FM 38–5	Logistics Maintenance Management.
SB 3–34	Maintenance Float, Chemical Corps Equipment.
SB 3–37	No Depot Maintenance List—Chemical Corps Equipment.
SB 3–38	Cannibalization as a Source of Low Mortality Repair Parts.
TM 3-Series	
SM 3-Series	

4.43. Repair Parts Requirements

Planning factors for initially computing repair parts tonnages are given in paragraph 4.13.

a. Maintenance units use the parts list portion ("Repair Parts and Special Tools List") of the technical manuals as a guide to initial stockage until sufficient demand and usage are generated. When new end items are initially distributed, or when there is a major shift in end item population, these "parts lists" are often used by the inventory control point to make automatic shipments of repair parts to the user.

b. As soon as possible, the authorized stockage lists of maintenance units will be based on demand data in accordance with AR 711–16. The authorized stockage list is furnished to the maintenance unit by the supporting stock record activity.

c. Controlled cannibalization is a very important local supply source for certain repair parts. For example, cannibalization may be a major source for fringe items. See AR 750–50 and SB 3–38.

4.44. Maintenance Float

SB 3–34 authorizes stockage of end items at field maintenance units for issue to using units when timely repair of unserviceable equipment cannot be accomplished by the field maintenance activity. The turn-in of unserviceable items and the issue of maintenance float items are supply transactions and subject to procedures as set forth in AR 711–16.

4.45. Chemical Maintenance Production Capability

a. General. The following factors can be used to determine personnel requirements for maintenance support of materiel and computation of backlogs and workloads. The items to be considered include—

(1) Supported end item density.

(2) Repair frequency (this is expressed as the number of times an item requires repair per year).

(3) Maintenance man-hours per item per year.

(4) Productive man-hours per man per year. Of the total 12 duty hours per day normally considered available in the combat zone, experience has indicated that 2 hours are required for miscellaneous administrative matters (such as meals, personnel matters, drawing supplies, obtaining and returning tools and equipment). Of the 10 remaining duty hours, 25 percent are required for movement of the unit, including preparation and dismantling of bivouac and local defenses, and 25 percent are required for non-MOS military duties, illness, rest, and recuperation and for time lost due to adverse physical conditions. Average MOS productive hours are therefore:

(12—2) ×360×75 percent ×75 percent
=2,025 productive man-hours per year.

Note: Above formula extracted from SR 310–30–15, changes No. 2.

b. Quantitative Personnel Requirements. The factors given in *a* above are used in formulas to determine quantitative personnel requirements as follows:

Supported item density × repair frequency per year
= workload per year per item.

Number hours per day ×360×75 percent ×75 percent
= total productive man-hours per year per man.

$$\text{Workload per year per item} \times \frac{\text{maintenance man-hours per job}}{\text{productive man-hours per year per man}} = \text{direct maintenance personnel required.}$$

Example:

How many maintenance personnel are required to support 100 decontaminating apparatus, power-driven, truck-mounted, M3A3? Repair frequency is 3 times per year with an average of 8 man-hours per job.

$$\frac{(100\times3)\times8}{2{,}025}=\frac{2{,}400}{2{,}025}=1.18$$ (maintenance personnel required to support 100 items).

c. Daily Shop Production Capability. Daily shop production capability is determined by multiplying the number of direct labor personnel available by the productive man-hours available per day. This gives the total number of man-hours available. By comparing the number of man-hours available with the total number of man-hours required to complete all jobs on hand in the shop, a determination of the number of days of maintenance backlog can be made. Paragraph 4.47 gives the number of direct labor personnel authorized by TOE. Overages or reduction in strength will change the capability of the unit.

4.46. Maintenance Time Factors for Selected Items of Chemical Corps Equipment

Equipment	Man-hours required for preventive maintenance per month	Man-hours required for organizational maintenance per month	Number of times field maintenance performed per year	Man-hours required for field maintenance per job	Total man-hours required for field maintenance per year
Apparatus, filling, field, landmine, M2	10	5	4	1	4
Breathing apparatus, compressed air, ABC–M15A1	30	5	4	2	8
Compressor, reciprocating, power-driven, 7 CFM, M1 and M1A1	15	10	4	6	24
Compressor, reciprocating, power-driven, flame thrower, 3½ CFM, AN–M4	15	5	3	5	15
Decontaminating apparatus, portable, DS2, 1½-qt, ABC–M11	15	4	3	3	9
Decontaminating apparatus, power-driven, trailer-mounted, 200-gal., M8A2	30	10	3	8	24
Decontaminating apparatus, power-driven, truck-mounted, M3A3	30	10	3	8	24
Dispensing pump, hand-driven, M2A1	1	1	2	1	2
Filter unit, gas-particulate, GED or EMD, 600 or 1200 CFM	20	10	4	5	20
Filter unit, gas-particulate, hospital, six-man, 12 CFM, M7 and ABC–M7A1	4	5	2	3	6

4.46. Maintenance Time Factors for Selected Items of Chemical Corps Equipment—Continued

Equipment	Man-hours required for preventive maintenance per month	Man-hours required for organizational maintenance per month	Number of times field maintenance performed per year	Man-hours required for field maintenance per job	Total man-hours required for field maintenance per year
Filter unit, gas-particulate, tank, three-man, 12 CFM, M8A2; four-man, 12 CFM, M8A3; and five-man, 20 CFM, M13	7	15	2	6	12
Flamethrower, mechanized, main armament, APC-mounted, M10-8	30	30	4	12	48
Flamethrower, mechanized, main armament, turret-mounted, M7A1–6	30	30	4	12	48
Flamethrower, portable, M2A1, M2A1–7, and ABC–M9–7	15	30	3	2	6
Generator, smoke, mechanical, pulse jet, ABC–M3A3	30	10	3	4	12
Heater, water, oil, skid-mounted, 600 GPH, M2	30	10	4	3	12
Mask, protective, field, M9A1	4	1	4	.17	.68
Mask, protective, field, M17	4	1	4	.17	.68
Mask, protective, tank, M14, ABC–M14A1, and M14A2	4	1	4	.17	.68
Mechanism, valve replacement, M1	4	4	2	4	8
Riot control agent disperser, helicopter- or vehicle-mounted, M4	10	5	2	2	4
Riot control agent disperser, portable, M3	15	30	3	2	6
Riot control agent disperser, skid-mounted, GED, 5,000 CFM, M2	30	10	4	5	20
Service kit, portable flamethrower—riot control agent disperser, M27	15	10	4	3	12
Service unit, flamethrower, truck-mounted, M4	30	30	6	6	36

4.47. Director Labor Personnel (Maintenance Activities Only)

TOE No.	Title	Authorized strength	Direct labor [a]
3–7D	Cml co, combat spt	246	[b] 42
3–47E	Cml maint co	99	[c] 72
3–147E	Cml gen spt co	131	46
3–500E	Team EA, maint	20 [d] (17)	17 [d] (14)
3–500E	Team EB, maint	48 [d] (32)	40 [d] (26)

[a] Direct labor includes only maintenance personnel and first level supervisory personnel.

[b] Direct labor given is the total for the company; each platoon of the chemical combat support company has a direct labor total of 7.

[c] The chemical maintenance company has two separate and distinct capabilities: one for repair of masks and breathing apparatus, and one for repair of chemical general equipment. The mask repair platoon has 32 direct labor personnel, and the equipment repair platoon has 40 direct labor personnel.

[d] Reduced strength.

4.48. Suggested Basic Load of Metal Stock for use by Chemical Maintenance Units Having a Shop Set, Field Maintenance, Machine, Basic and Supplement No. 1

Nomenclature	Diameter, size, or thickness (in.)	Quantity
Steel plate, carbon	48 x 48	1 sheet.
Steel bar, carbon, cold finish, hexagon.	3/16	12 ft.
Do	1/4	Do.
Do	5/16	Do.
Do	3/8	Do.
Do	7/16	Do.
Do	1/2	Do.
Do	5/8	Do.
Do	3/4	Do.
Do	7/8	Do.
Do	1	Do.
Steel bar, carbon, cold finish, round.	1/8	Do.
Do	3/16	Do.
Do	1/4	Do.
Do	5/16	Do.
Do	3/8	Do.
Do	7/16	Do.
Do	1/2	Do.
Do	9/16	Do.
Do	5/8	Do.
Do	11/16	Do.
Do	3/4	Do.
Do	7/8	Do.
Do	1	Do.
Tool steel, carbon, hexagon	3/8	Do.
Do	1/2	Do.
Do	3/4	Do.
Do	1	Do.
Tool steel, carbon, round	0.0125	Do.
Do	0.1875	Do.
Do	0.2500	Do.
Do	0.3125	Do.
Do	0.3750	Do.
Steel sheet, carbon, cold rolled	0.0149	30 sq ft.
Do	0.0239	40 sq ft.
Do	0.0478	32 sq ft.
Do	0.1048	32 sq ft.
Aluminum alloy bar	3/4	20 ft.
Naval brass rod, hexagon	1/4	10 ft.
Do	1/2	Do.
Do	3/4	Do.
Do	1	Do.
Naval brass rod, round	1/4	Do.
Do	1/2	Do.
Do	3/4	Do.
Do	1	Do.
Do	1 1/4	Do.
Do	1 1/2	Do.
High leaded tin bronze cast bar, cored.	1	Do.
Do	1 1/2	Do.
Do	2	Do.
Do	2 1/2	Do.
Do	3	5 ft.
Do	4	Do.
Aluminum alloy sheet	0.050	18 sq ft.
Copper sheet	0.0486	Do.
Pipe, steel, seamless or welded, standard weight.	1 in. diam	40 ft.
Steel, angle, black	2 x 2 x 3/16	15 ft.

4.49. Covered Shop Requirements of Chemical Units [a]

Unit	Square feet	Unit	Square feet
Cml dep co, COMMZ.	1,000	Cml pro co	11,900
		Lab team HA	1,000
Cml lab	5,200	Maint team EA	900 [b](700)
Cml maint co	4,600	Maint team EB	2,000 [b](1,400)

[a] This chart includes only those chemical units found in the communications zone. Units in the field army are provided necessary tentage for minimum covered shop requirements.

[b] Reduced strength.

CHAPTER 5

CHEMICAL SERVICE

Section I. DECONTAMINATION

5.1. References

References pertinent to decontamination include FM 21–40, FM 21–41, FM 21–48, TM 3–215, TM 3–220, TM 3–223, TM 3–500, TM 5–700, TM 8–285, TB CML 40, and TB CML 41.

5.2. Decontaminating Apparatus and Equipment

Decontaminating apparatus are either power driven or operated by compressed gas pressure.

a. Truck-Mounted Power-Driven Decontaminating Apparatus. The truck-mounted power-driven decontaminating apparatus is mounted on the chassis of a standard 2½-ton, 6 x 6 truck. The data given below are applicable to the M3A3 model. Other models include the 400-gallon M3A2, the M9 truck-mounted power-driven decontaminating apparatus, and the 200-gallon M8A2 trailer-mounted power-driven decontaminating apparatus. For additional information, see TM 3–500, TM 3–223, and TM 3–4230–200-series.

Performance

Working pressure	400 pounds per square inch.
Time required for—	
Loading tank with water	10 minutes.
Loading tank M1 antiset	1 minute.
Loading tank with M2 antiset	2 minutes.
Mixing antiset and water	2 minutes.
Loading tank with bleach	20 minutes.
Mixing bleach and water	15 minutes.
Coverage per filling (average for smooth surface)	1,300 square meters.
Discharge rate for slurry (one spray gun)	13 gallons per minute.
Discharge rate for slurry (two spray guns)	25 gallons per minute.
Discharge rate for water (two spray guns)	30 gallons per minute.

Capacities

Tank (working capacity)	400 gallons.
Water per filling (for slurry)	225 gallons.
Bleach per filling	1,300 pounds.
M1 antiset per filling	6½ pounds.
M2 antiset per filling	12½ pounds.

Weight and dimensions of unit (truck and apparatus)

Weight (empty)	14,280 pounds.
Weight (filled)	17,690 pounds.
Height	105 inches.
Length	261 inches.
Width	87 inches.

b. Portable Decontaminating Apparatus. The M11 1½-quart DS2 portable decontaminating apparatus is used to decontaminate a vehicle or a crew-served weapon to the minimum extent necessary to allow continued operation. The apparatus produces a spray of decontaminating agent DS2 by means of a nitrogen cylinder which pressurizes the container. The following data are applicable to the M11 apparatus:

Capacity	1⅓ quarts.
Filling	DS2 solution.
Weight of empty apparatus	3.0 pounds.
Weight of filling (1⅓ quarts of DS2 solution)	2.9 pounds.
Weight of filled apparatus	6 pounds.
Effective spray range	6 to 8 feet.
Coverage per filling	15 square yards.

c. Water Heater. The M2 600-gallon-per-hour skid-mounted oil water heater is used with the power-driven decontaminating apparatus to provide hot water for decontaminating purposes and for the field bathing of troops. The heater is capable of raising the temperature of 600 gallons of water per hour through 100° F. The M1 water heater is a substitute for the M2 model. For additional information, see TM 3–500 and TM 3–228.

5.3. Chemical Decontamination

The more common and effective decontaminants for chemical agents are shown in *a* below. In addition to those listed in the table, the following decontaminants may be used to destroy or remove toxic chemical agent contamination: lime, bleach, baking soda, chlorine, ammonia, caustic potash, sodium sulfite, chloramine-T, dichloramine-T, alcoholic caustic soda, and alcoholic caustic potash. Aeration is a method of decontamination for toxic chemical agents, particularly nonpersistent effect agents. Aeration also is a method for decontaminating lightly contaminated clothing and fabric material. Gentle heating accelerates evaporation and can be used to decontaminate many fragile and complicated items. Hot or cold water alone, or in combination with soaps or detergents, may be used to remove toxic chemical agents from surfaces that can be washed. Various common organic solvents may be used to remove contaminants from equipment that might be damaged by water. These include kerosene and allied petroleum fractions (diesel fuel, naphtha, and dry-cleaning fluid), alcohol, and carbon tetrachloride. Since water and organic solvents effect only a removal of contaminants and do not neutralize them, suitable precautions must be taken to dispose of the solvent waste as contaminated material.

a. Decontaminants for Toxic Chemical Agents.

Decontaminant	Chemical agent used against—	Decontaminant container	Remarks
DANC solution	Blister agents, V-agents	3-gal. and 4½-gal. containers.	2.5-lb RH 195 decontaminating agent per 3-gal. acetylene tetrachloride.
Detergent and wetting agent	Persistent effect agents, G-agents.		
GUNK	Persistent effect agents	55-gal. drum	Water-dispersible solution (1.34-lb GUNK per gal. kerosene).
HTH (high test bleach)	Blister agents, G- and V-agents.		Oxidizing agent; releases chlorine.
M5 protective ointment	Blister agents, V-agents	¾-oz tube	Salve.
Sodium carbonate (washing soda).	G-agents, irritant agents		White, alkaline powder; dissolves easily in water.
Sodium hydroxide (caustic soda or lye).	Persistent effect agents, G-agents.	Steel drum	Water solution (0.5-lb lye per gal. water).
Sodium hypochlorite (household bleach).	Blister agents, G- and V-agents.	Carboy or barrel	Unstable as solid; more stable in solution.
STB (supertropical bleach)	Blister agents, G- and V-agents.	8-gal., 50-lb can	White powder containing 30 percent available chlorine.
Steam	Blister agents, G-agents		Hydrolyzes certain chemical agents.
Soap and water	Blister agents, G-agents.		
DS2 solution	All chemical agents.	1⅓-qt. cans or 5-gal. drums.	Applied by M11 apparatus or by brushes, brooms, or swabs.

b. Recommended Decontaminants for Individual Chemical Agents on Materiel. See chapter 2 of TM 3–220 for further information.

Chemical agents	Decontaminants [1]	Remarks
G-agents (GA, GB, GD)	Slurry, hot soapy water, alkali solution,[2] or DS2.	STB and GA produce toxic vapors; in confined areas steam and ammonia should be used.
V-agents	DS2, slurry, DANC solution M5 protective ointment, or 5-percent sodium hypochlorite solution.	Liquid V-agents do not evaporate rapidly or freeze at normal freezing temperatures. Absorbed, V-agents remain toxic for some time. (See TC 3–10 for further information.)
Mustards (H, HD, HN, HQ, HT)	STB, slurry, DANC solution, DS2, or M5 protective ointment.	Dry STB on liquid mustard produces flame and toxic vapors. In sealed container, stable up to 10 years.
Lewisite (L), mustard-lewisite mixture (HL), phenyldichloroarsine (PD), ethyldichloroarsine (ED), methyldichloroarsine (MD).	STB, slurry, DANC solution, DS2, water, or caustic soda.	Decontamination products are toxic, fairly stable, nonvolatile, and insoluble in water. Alkali solutions [2] destroy vesicant properties.
Phosgene oxime (CX)	Large amounts of water or DS2	Liquid above 39°F. Readily soluble in water.
Phosgene (CG)	Water followed by alkali solution [2] or DS2.	CG liquid below 47°F.
Cyanogen chloride (CK), hydrocyanic acid (AC).	Sodium hydroxide solution or DS2	CK liquid below 55°F. AC liquid below 77°F.
Adamsite (DM)	Slurry or DS2	Aeration is sufficient in the field.
Diphenylchloroarsine (DA), diphenylcyanoarsine (DC).	Alkali solution [2] or DS2	Aeration is sufficient in the field.
CS	Water or 5-percent sodium bisulfite solution.	See TC 3–9 for further information.
Chloroacetophenone (CN), CN solution (CNB, CNC, CNS [3]).	Hot sodium carbonate solution, hot sodium hydroxide, or hot soapy water.	Aeration is sufficient for vapors.
White phosphorus (WP) or plasticized white phosphorus (PWP).	Water or copper sulfate solution	Water extinguishes burning WP; copper sulfate prevents further burning.
Sulfur trioxide-chlorosulfonic acid (FS).	Alkali solution,[2] water followed by alkali solution,[2] or hot soapy water.	Corrosive to metals when moist; acidic, destroys nylon and paint.
Titanium tetrachloride (FM)	Water or alkali solution [2]	Corrosive to metals.
HC mixture (HC)	Water or alkali solution [2]	No decontamination required for vapor. High concentrations toxic.

[1] Decontaminants are listed for chemical agents in liquid or solid state. In addition to decontaminants listed, aeration is effective for most chemical agents (vapors and light contamination) except V-agents. Screening smokes generally require no decontamination except aeration.

[2] Ten-percent solution of caustic soda, washing soda, baking soda, or household ammonia; 5-percent solutions are recommended for fabrics to include canvas and leather (par. 5.3*c*).

[3] In closed spaces, sodium sulfite is used for CNS.

c. Decontamination of Surfaces and Materials Contaminated with Toxic Chemical Agents.[1] See chapter 2 and appendix III of TM 3–220 for further information.

Contaminated surface or object	Preferred decontamination methods	Alternate decontamination methods	Field expedient methods
Asphalt:			
Roads [2]	Flush with water. Spray with slurry from power-driven decontaminating apparatus.	Cover with STB; when liquid contaminant is visible and personnel are nearby, use dry mix.	Weather. Cover small areas or paths across roads with 4 inches of earth.
Roof	Flush with water. Spray with slurry from power-driven decontaminating apparatus.	Cover with STB or dry mix	Weather.
Brick and stone:			
Roads [2]	Spray with slurry from power-driven decontaminating apparatus or apply with brushes and brooms. Let remain 24 hours before flushing.	Wash with soapy water, preferably hot.	Cover small areas or paths across roads with 4 inches of earth. Weather.
Buildings	Spray with slurry from power-driven decontaminating apparatus or apply with brushes and brooms. Let remain 24 hours, then flush with water.	Wash with soapy water, preferably hot. Use STB or dry mix around buildings where waste water runs.	Weather.
Canvas:			
Tarpaulin, tentage, covers, mask carriers, cartridge belts.	Immerse in boiling soapy water for 1 hour. Use 5-percent solution of sodium hypochlorite (household bleach for V-agents. Use 5-percent solution of washing soda for G-agents.	Immerse in boiling water for 1 hour. Launder by standard methods. (Refer to pertinent QM publications.) Use DANC solution or DS2. Use slurry.	Aerate (except for V-agents).
Concrete:			
Roads [2]	Spray with slurry from power-driven decontaminating apparatus.	Cover with STB or dry mix	Weather. Cover small areas or paths across roads with 4 inches of earth.
Buildings, pillboxes, gun emplacements, tank obstacles.	Spray with slurry from power-driven decontaminating apparatus or apply with brushes and brooms. Let remain 24 hours, then flush with water.	Wash with soapy water, preferably hot. Apply STB or dry mix on ground surrounding structure where waste water flows.	Cover small areas with 4 inches of earth if practicable.
Earth:			
Roads,[2] gun emplacements, bivouac areas, pathways, bomb craters.	Spray with slurry from power-driven decontaminating apparatus.	Cover with STB or, when liquid contaminant is visible and personnel are nearby, use dry mix.	Weather. Burn. Cover small areas or paths across roads with 4 inches of earth. Scrape layer of contaminated earth to side of road.
Leather:			
Boots, gloves, and other items.	Scrub with hot soapy water and rinse. Immerse in soapy water at 120°F. for 4 hours and rinse.	Immerse in a 5-percent solution of sodium hypochlorite for V-agents. Use 5-percent washing soda solution for G-agents.	Aerate.

See footnotes at end of table.

c. Decontamination of Surfaces and Materials Contaminated with Toxic Chemical Agents[1]— Continued

Contaminated surface or object	Preferred decontamination methods	Alternate decontamination methods	Field expedient methods
Fabrics (cotton or wool):[3]			
Coveralls, shirts, trousers, field jackets, underwear, socks, gloves, overcoats, ties, hoods, barracks bags.	*For cotton items:* Immerse in boiling water for 1 hour; stir items; add 1 lb of soap to 10 gal. of water to make water alkaline. Use 5-percent solution of sodium hypochlorite (bleach) for V-agents. Use 5-percent solution of washing soda for G-agents. *For woolen items:* Extract with solvent. Immerse in warm (100° F.) soapy water for 1 hour or longer with light agitation; dry items slowly.	Launder by standard methods. (Refer to pertinent QM publications.) Dry-clean. Use DS2 for cotton items only.	Rub M5 protective ointment on small contaminated areas. Aerate except for V-agents.
Glass:			
Windows	Use 5-percent solution of sodium hypochlorite for V-agents. Spray with DS2 or DANC solution.	Wash with hot soapy water Wash with clear water or organic solvent.	Blot off surface. Aerate. Weather.
Lenses	Use 5-percent solution of sodium hypochlorite for V-agents. Spray with DS2 or DANC solution.	Wash with hot soapy water Wash with clear water or organic solvent.	Blot off surface. Aerate.
Grass and low vegetation (fields, open terrain).[2]	Burn Spray with slurry from power-driven decontaminating apparatus.	Cover with STB or dry mix	Burn. Explode drums of STB decontaminating agent. Clear paths through area by use of detonating cord or other detonating devices.
Metals (unpainted):			
Ammunition	Use DS2 or DANC solution; then rinse or wipe with organic solvent and dry.	Wash with *cool* soapy water and rinse.	Aerate.
Machinery	Spray with DANC solution or DS2 and rinse.	Wash with hot soapy water Wash with organic solvent	Weather. Aerate.
Mess gear, canned rations.	Immerse in boiling soapy water for 30 minutes and rinse. Immerse in boiling water for 30 minutes.	Spray with DS2 or DANC solution and rinse. Wash in hot soapy water, rinse, and aerate.	
Metals (painted):[4]			
Vehicles, weapons, equipment.	Spray with DS2 or DANC solution.	Wash with hot soapy water and rinse. (Slurry may be used if it is removed from surface after 1 hour and surface is oiled.)	Aerate. Weather.

See footnotes at end of table.

c. Decontamination of Surfaces and Materials Contaminated with Toxic Chemical Agents [1]— Continued

Contaminated surface or object	Preferred decontamination methods	Alternate decontamination methods	Field expedient metbods
Plastics [5] (opaque):			
Insulation, telephones, panel boards.	Spray with DS2 or DANC solution and rinse.	Wash with hot soapy water and rinse. Wipe with organic solvent and then rinse.	Weather. Aerate.
Plastics [5] (transparent):			
Eyepieces	Spray with DS2 and rinse	Wash with hot soapy water and rinse. Wipe with organic solvent and aerate.	Aerate.
Airplane canopies	Spray with DS2 and rinse	Wash with hot soapy water Wipe with organic solvent and aerate.	Weather.
Rubber (impermeable):			
Aprons, suits, and other items.	Spray with DS2 and rinse after 30 minutes. Immerse in hot soapy water (just below boiling point) for 1 hour; do not agitate. Rinse with clear water and hang up to dry. For G-agents, use 10-percent washing soda solution, rinse off, and aerate.	Apply hot soapy water with brushes and rinse. Spray with slurry from power-driven decontaminating apparatus. After a few minutes, wash off with clear water.	Aerate. Weather.
Rubber (natural and synthetic):			
Gloves, boots	Spray with DS2 and rinse Immerse in slurry solution for 4 hours, rinse off, and aerate.	Immerse in hot soapy water for 2 to 8 hours; do not boil more than four times a year.	Apply M5 protective ointment immediately. Aerate.
Mask facepieces and other rubber articles coming in direct contact with the skin.	Spray with DS2 and rinse	Immerse in hot soapy water for 6 to 8 hours for heavy contamination and 3 hours for moderate contamination. Do not boil more than four times a year.	Apply M5 protective ointment immediately. (Apply to both sides of mask face piece.)
Tires, hose, mats, insulation.	Spray with DS2 and rinse Apply thick slurry, allow slurry to remain at least 30 minutes, then flush with clear water. (May be left on tires.)	Immerse in water for 2 to 3 hours; do not boil more than four times a year.	Aerate. Weather.
Sand [2] (beaches, deserts).	Flush with water	Spread STB or slurry over surface.	Weather. Cover paths with roofing paper. Scrape off 2 to 3 inches of contaminated top layer.
Undergrowth and tall grass (meadows, jungles, forests).[2]	Burn	Spray slurry from power-driven decontaminating apparatus.	Weather. Explode drums of STB. Clear paths with detonating cord, bangalore torpedoes, or demolition snakes.

See footnotes at end of table.

c. Decontamination of Surfaces and Materials Contaminated with Toxic Chemical Agents [1]—Continued

Contaminated surface or object	Preferred decontamination methods	Alternate decontamination methods	Field expedient methods
Wood:			
Buildings, vehicle bodies.	Apply slurry with power-driven decontaminating apparatus, brooms, or swabs. Let slurry remain 12 to 24 hours; flush and repeat application, then flush again.	Scrub with hot soapy water and rinse.	Weather.
Boxes, crates, gunstocks.	Apply slurry with power-driven decontaminating apparatus, brooms, or swabs. Let slurry remain 12 to 24 hours; flush and repeat application, then flush again. (Scrub slurry off gunstocks with soapy water and rinse.)	Scrub with hot soapy water and rinse.	Weather.
Wood (painted surface):[4]			
Buildings, boxes	Apply slurry with power-driven decontaminating apparatus, brooms, or swabs. Let slurry remain 12 to 24 hours, then rinse off with water.	Scrub with hot soapy water and rinse. Use DS2 and rinse.	Weather.

[1] DANC is not recommended for G-agent decontamination; 10-percent alkaline solutions are recommended for G-agent decontamination on material except fabrics to include canvas and leather.
[2] Applicable to small vital areas only.
[3] DS2 is not recommended for woolen items.
[4] DS2 may soften fresh paint.
[5] DS2 and DANC solution are destructive to plastics if not rinsed from them.

d. Decontamination Process Time Factors. Time factors for chemical decontamination processes are given below. Decontamination coverage in square meters is also listed.

Time Factors for Decontamination of Persistent Chemical Agents

Means	Filling and mixing time (minutes)	Discharge time (minutes)	Coverage (square meters)
Slurry with 400-gal. power-driven decontaminating apparatus.	40 to 45 (2 men adding bleach)	16, continuous spray (1 hose—13 GPM; 2 hoses—25 GPM).	1,300 (smooth surface); 650 (short grass); 400 to 433 (tall grass and brush).
Hot water and soap or detergent cleansing solution with 400-gal. power-driven decontaminating apparatus.	25 (2 heaters), 40 (1 heater)	Same as for slurry if continuous; 35 to 45, scrubbing and cutting rinse.	100 (metal surface).
Dry mix	5 to 10 (2 men mixing 50 lb of bleach).	45 to 60	50 per hour per man.[1]
Bleach (unmixed)	2 (50 lb)	30 to 45	125 per hour per man.[1]
DANC (3-gal. can)	10 (DANC solution or hot, soapy water).	10	50, or 1 cargo truck (3 applications).
DS2	2 (no mixing required)		15

[1] Divide by 2 for gravel; divide by 3 for tall grass and brush.

e. Storage Data for Decontaminants. Storage data on several decontaminants for chemical agents are shown below. Decontaminants not listed are adequately stable in storage.

Decontaminant	Storage characteristics	Surveillance requirements	
Acetylene tetrachloride	Stable; attacks metals in the presence of moisture.	*Mean shade temperature in hottest months*	*Frequency of inspections*
		Over 90°F.	Every 6 months.
		70° to 90°F.	Every 9 months.
		Under 70°F.	Every 12 months.
STB	Stable for 6 weeks at temperatures up to 158°F. Stable for 10 years in airtight containers.	Routine surveillance to detect defects in drums.	
RH 195	Decomposes gradually; should be stored in cool, dry place.	Routine surveillance to detect defects in drums.	
Sodium hydroxide	Stable in tightly sealed drums; absorbs moisture and carbon dioxide.	Routine surveillance to detect defects in drums.	
DS2	Serviceable after 4 years storage in bulk containers or after 6 months storage in spray containers. Can be stored in all climatic conditions for at least 9 weeks.	Inspect after 9 weeks when stored in desert or tropic areas.	
BPL	Polymerizes at ambient temperature (70°F.) in about 3 months, producing an undesirable residue. Stable for long periods when refrigerated (40°F.).	Inspect as follows: monthly when stored at temperatures above 70° F.; every 3 months when stored at 70°F.; every 6 months when stored at 40°F. or lower.	

5.4. Decontamination of Biological Agents

Decontaminants and decontamination procedures for toxic chemical agents are usually effective against biological agents. Decontaminants are listed in *a* and *b* below and a brief outline of applicable methods for decontamination are listed in *c* below.

a. Chemical Decontaminants for Biological Agents.

Decontaminant	Application	Limitations	Remarks
Decontaminating agent, biological, beta-propiolactone (BPL).	Used primarily for decontamination of interiors of buildings and equipment under tarpaulins. The vapors of BPL liquid are applied by an insecticide sprayer. Two Corps of Engineer disseminators used for spraying BPL are sprayer, insecticide, push-cart-mounted, mist-type, gasoline-driven, 30 GPH; and sprayer, insecticide, skid-mounted, fog, gasoline-driven, 40 GPH. Spray 1 qt of BPL for each 4,000 cu ft. The minimum effective temperature is 40° F., and the minimum effective relative humidity is 70 percent. The exposure time is 2 hours at temperature of 70° F. or above (double exposure time for each 18° F. below 70° F.). Gastight sealing is not required; however, major openings must be sealed. After exposure the area should be well aerated before it is reoccupied. Aeration may require as long as 24 hours.	Vapors are highly toxic. Beta-propiolactone vapor will not penetrate cloth and similar material as effectively as will ethylene oxide. Care should be exercised while spraying not to let liquid BPL collect on surfaces, since some materials are affected by the liquid.	Before a building is reoccupied after decontamination with BPL vapor, it should be tested for residual vapor. This test is made by use of the blue dot detector tube of chemical agent detector kits. The test is identical to the one for mustard. Personnel should wear protective masks when exposed to BPL, and if they intend to remain in the area more than a few minutes they should also wear impermeable protective clothing.

a. Chemical Decontaminants for Biological Agents—Continued

Decontaminant	Application	Limitations	Remarks
Formaldehyde solution (formalin), USP, 5 parts formaldehyde, 3 parts methanol mixture.	Applied as a vapor by heat, paint-spraying equipment, high-pressure, or steam bubbled through pan of material. The minimum effective relative humidity is 70 percent. The exposure time should be at least 16 hours. The minimum effective temperature for the use of formaldehyde is 60° F., at which temperature the exposure time should be increased to 24 hours. Methanol can be added to formalin in the proportion of 0.5 qt formalin to 0.3 qt methanol. The additional methanol would reduce polymerization of formaldehyde, thus decreasing subsequent aeration time before reentry. Spray 0.8 qt of this mixture per 1,000 cu ft of space.	Vapors are highly toxic. Vapors are flammable and should not be subjected to open flame. When steam is used to vaporize, steam source should be outside the area being decontaminated. Formaldehyde vapor will not penetrate cloth and similar material as effectively as will ethylene oxide. Open flame is not suitable for vaporizing. May cause damage to delicate instruments; dampness may curl and ripple paper. Rubber gloves or protective material is required to cover the skin of handlers. To be usable, buildings require 24-hour aeration after formalin vapor is used. Vapor polymerizes and deposits white toxic powder on horizontal surfaces; hot water is used for washing off powder deposit. Personnel should wear oxygen generating masks when handling formaldehyde solution.	Once vaporization has started, even persons wearing masks should not enter area until process is completed. Formalin is packaged in 55-gal. drums.
Ethylene oxide-chlorofluoromethane mixture (contains 11 percent ethylene oxide, 44.5 percent dichlorodifluoromethane, 44.5 percent trichlorofluoromethane).	Contaminated equipment or clothing is exposed to the vapors in gastight bag, a 55-gal. drum, or other chamber. The M10 ethylene oxide dispenser may be used. Use one dispenser per polyethylene bag (2½ by 6 ft when laid flat) or per 55-gal. drum. The exposure time to the ethylene oxide mixture is 8 hours at 70° F. or higher. The minimum relative humidity is 30 percent. The minimum temperature is 60° F., at which temperature the exposure time should be increased to 12 hours.	Inclosure must be gastight for this decontaminant to be effective. Since ethylene oxide is a *nonexplosive* mixture, it can be used in buildings. Ethylene oxide is toxic; avoid breathing it.	The mixture is noncorrosive.
Carboxide (a mixture containing 10 percent ethylene oxide and 90 percent carbon dioxide).	Contaminated equipment is exposed to carboxide gas in a gastight chamber for 24 hours. A building must be tightly sealed when used as an improvised chamber. Sprayed plastic can be used to form an airtight seal. To conserve gas the chamber selected should be as small as practicable.	Inclosure must be gastight for this decontaminant to be effective. As carboxide gas is not explosive in mixtures of air, it is suitable for use in buildings. Carboxide gas is toxic;	Carboxide is noncorrosive. Cylinders do not require heating to release gas at suitable rate. Carboxide is packaged in 60-lb cylinders.

a. Chemical Decontaminants for Biological Agents—Continued

Decontaminant	Application	Limitations	Remarks
	For each 1,000 cu ft of space, 60 lb of carboxide are required. The minimum effective temperature is 60° F.	avoid breathing it.	
Ethylene oxide	Contaminated equipment is exposed to ethylene oxide vapor under a gastight tarpaulin for 12 hours at 70° F. or above. Edges of tarpaulin should be covered with earth. Ethylene oxide is introduced at bottom of shelter. A hose is connected at top of shelter and closed when ethylene oxide starts to escape. For each 1,000 cu ft of space, 30 lb of ethylene oxide are required. The minimum effective temperature is 60° F., at which temperature the exposure time should be increased to 18 hours. Ethylene oxide is highly penetrating and noncorrosive.	Inclosure must be gastight for ethylene oxide to be effective. *Ethylene oxide is highly explosive* in air in any concentration between 3 and 80 percent by volume. It is not suitable for use in buildings. Ethylene oxide is toxic. If ground is wet a protective cover should be placed beneath gas-resistant tarpaulin. To release ethylene oxide at a suitable rate, cylinders should be heated in water bath. Since ethylene oxide is very flammable and toxic, it must be used with caution and only by specially trained personnel. Personnel subject to concentrated vapors should wear oxygen generating mask.	Tarpaulins may be treated with very heavy vinyl plastic coating. Ethylene oxide is packaged in 100-lb cylinders. Must be stored away from fires. Cylinders should be protected from rough handling and sparks.
Detrochlorite	Detrochlorite is a thickened bleach containing 19.3 percent (by weight) diatomaceous earth, 0.5 percent anionic wetting agent, 2.9 percent calcium hypochlorite (70 percent available chlorine), and 77.3 percent water. It is applied to vertical surfaces by means of a 3-gal. or 400-gal. decontaminating apparatus. Following a contact period of at least 30 minutes, the mixture is removed by merely washing the surface with a stream of water.	Very corrosive to metals	Average coverage of the mixture is 1 gal. per 7 square meters. Mix wetting agent and diatomaceous earth with water before adding the calcium hypochlorite. Mixing the wetting agent and calcium hypochlorite in a dry undiluted state may result in an explosion.
Chlorinated lime (grade 3).	Slurry (40 parts chlorinated lime and 60 parts water, by weight) is applied to vertical surfaces by means of 400-gal. decontaminating apparatus.	Very corrosive to metals	Average coverage of slurry is 1 gal. per 7 square meters. When slurry is prepared, 1½ lb antiset are added per 100 lb bleach.
Decontaminating agent STB.	Clear solution (5.8 parts STB and 94.2 parts water) is sprayed on horizontal surfaces.	----------	Decomposes very slowly in storage. Packaged in 8-gal. drums.
Sodium hypochlorite (household bleach).	Can be sprayed (diluted half and half with water) by means of 3-gal. or 400-gal. decontaminating apparatus.	----------	Should be stored in cool place.

a. Chemical Decontaminants for Biological Agents—Continued

Decontaminant	Application	Limitations	Remarks
Calcium hypochlorite (HTH).	Used in water purification.		
Sodium hydroxide (caustic soda or lye).	Used in Detrochlorite mixture above. Average application is 1 gal. per 7 square meters on horizontal surfaces; solution strength should be 10 percent by weight.	Highly toxic. Highly corrosive. Will damage fabrics. Solution should not be mixed in aluminum, copper, tin, or zinc containers.	Effectiveness is directly proportional to strength of solution. Solid caustic soda is stored in sealed steel drums to keep moisture out and to prevent absorption of atmospheric carbon dioxide. Caustic soda solution may be kept in steel or glass containers having rubber stoppers.

b. Chemical Chlorine Compounds for Biological Agent Decontamination.

Decontaminant	Use	Percent available chlorine as packaged	Recommended mix (parts by wt)		Type of surface to be treated	Approximate coverage		Packaging
			Decontaminant	Water		Gal.	Sq yd	
Calcium hypochlorite (HTH).	Water purification.	70	[a] 2.9	97.1	Horizontal concrete	1	8	
			[a] 2.9	97.1	Horizontal packed earth	1	2	
			2.9	[b] 77.1	Vertical surfaces	1	8	
STB or grade 3 chlorinated lime.[c]	Chemical decontamination.	30–35	5.8	94.2	Horizontal conrete	1	8	8-gal. drums.
			5.8	94.2	Horizontal packed earth	1	2	
			40	60	Vertical concrete	1	8	
Sodium hypochlorite (household bleach).	Bleaching	5	(Half strength)		Horizontal concrete	1	8	1-qt jars and 5-gal. carboys.
					Horizontal packed earth	1	2	

[a] This solution is more effective if 0.5 percent anionic wetting agent is added.
[b] Remainder of mixture is 19.3 percent diatomaceous earth and 0.5 percent anionic wetting agent.
[c] As bleach in storage for extended time will lose some available chlorine, concentration of mix must be increased appropriately.

c. Biological Agent Decontamination Methods. For detailed information see TM 3–220.

Item	Method	Remarks
Cotton clothing	Boiling in water for 15 minutes	
	Autoclaving for 45 minutes at 123° C	
	Immersion in 2-percent bleach solution for 30 minutes.	Immediate rinse required.
	Laundering	Destroys or inactivates all but highly resistant spore-forming organisms.
	Ethylene oxide gas in polyethylene bag or drum liner, or in delousing bag.	Leave in bag for 8 hours; then aerate for 1 hour. Rubber and plastic items should be aerated for 16 hours before they are worn.
	Methyl bromide vapors[1] in delousing bag	Leave in bag for 12 hours; then aerate for 2 hours to remove vapor.

See footnotes at end of table.

c. Biological Agent Decontamination Methods—Continued

Item	Method	Remarks
Fine instruments, mask facepieces.[2]	Ethylene oxide gas (11-percent ethylene oxide with chlorofluoromethane mixtures) in polyethylene bag or drum liner, or in delousing bag.	Leave in bag for 12 hours; then aerate for 1 hour. Rubber and plastic items that will be used in contact with the skin should be aerated 5 hours before being used. Metal instruments can be aerated in a few minutes.
	Methyl bromide vapors in delousing bags	Leave in bag for 12 hours; then aerate for 2 hours or wash to remove vapor.
Helmets and mess gear.	Ethylene oxide gas (11-percent ethylene oxide with chlorofluoromethane mixtures) in polyethylene bag or drum liner, or in delousing bag.	Leave in bag for 8 hours; then aerate a couple of minutes.
	Washing with soap and water and boiling for 15 minutes.	
	Methyl bromide vapors in delousing bags	Leave in bag for 12 hours; then aerate for 2 hours or wash to remove vapor.
Leather and rubber items.	Ethylene oxide gas (11-percent ethylene oxide with chlorofluoromethane mixtures) in polyethylene bag or drum liner, or in delousing bag.	Leave in bag for 12 hours. Items should be aerated for 5 hours before they are worn.
	Methyl bromide vapors in delousing bag	Leave in bag for 12 hours; then aerate for 2 hours to remove vapor.
	Scrubbing with soap and hot water for 20 minutes.	
Buildings:		
Interiors	Treat with beta-propiolactone	Spray 1 qt per 4,000 cu ft of space. Relative humidity must be 70 percent or higher. Aerate thoroughly afterwards.
	Fumigation with formaldehyde and steam	Spray 1 milliliter of formaldehyde solution per cu ft. Building is sealed before fumigation and thoroughly aerated afterwards.
	Spraying with formaldehyde (glycerin-formaldehyde can be used if formalin is not available).	Suitable for furniture and interior surfaces of buildings.
	Washing with soap and water	Suitable for interiors of buildings.
Exteriors	Weathering	Sun and rain eliminate some micro-organisms within a few hours.
	Apply Detrochlorite	Expose at least 30 minutes and flush with water.
Terrain:		
All	Weathering	Evacuate contaminated area and allow sufficient time for weathering.
All	Wetting with water	Will keep micro-organisms on ground.
Porous	Spraying with slurry (2-percent bleach solution).	Suitable to limited extent for some types of terrain.
Hard-surfaced roads.	Pouring, spraying, or spreading oil	Will keep micro-organisms on ground.
Vegetation	Burning with flamethrower	Can be used to burn off areas and passageways.
Air (in inhabited inclosed spaces).	Filter air by means of filter unit	Renders air relatively free from micro-organisms.
Water [3]	Boiling for 15 minutes	Effective against all micro-organisms.
	Chlorination or superchlorination	For heavy contamination. Follow with dechlorination.
Food [3]	Boiling in water for 15 minutes	
	Cooking	Thorough cooking insures destruction of micro-organisms.

See footnotes at end of table.

c. Biological Agent Decontamination Methods—Continued

Item	Method	Remarks
	Immersion in or spraying with 2-percent bleach solution.	Packaged food or food which is peeled or pared may be immersed or sprayed.
	Beta-propiolactone, ethylene oxide, formaldehyde vapor.	Use on covered or bottled foods.
Personnel [4]	Bathing with soap and warm water	Remove clothing and shower thoroughly.[5]
	Washing with hypochlorite	

[1] In five times the quantity used for ordinary delousing.
[2] To effectively decontaminate facepieces of protective masks, boil them in water. If boiling is impractical, wash in lukewarm soapy water, rinse in clear water, and then dry at room temperature.
[3] Should not be consumed until pronounced safe by a medical officer.
[4] Minor cuts and abrasions should be treated immediately.
[5] When showering, head should be held back to prevent runoff from passing over eyes, nose, and mouth.

5.5. Radiological Decontamination

Radioactive contaminants cannot be made safe by chemical action. They must be removed or shielded if it is impracticable to wait for natural decay. Therefore, radiological decontamination is the process of reducing the hazard of radioactivity to a permissible level by removal and disposal of the contamination or by shielding against the radiation.

a. Radiological Decontaminants.

Decontaminsnt	Type	Remarks
Soapless detergent, soap, wetting agent	Detergent	Practicable for field use.
Gasoline, kerosene, water	Solvent	Practicable for field use.
Steam	Solvent	Practicable for field use.
Potassium hydroxide, sodium hydroxide, trisodium phosphate, sodium orthosilicate.	Solvent	Practicable for field use.
Acetone, alcohol [1], ether, paint remover	Solvent	Practicable for small-scale operations only.
Citrates, citric acid, soidum versenates, polyphosphates.	Complexing agent	Practicable for small-scale operations only.
Aqua regia [2], hydrochloric acid, nitric acid [3]	Corroding agent	Practicable for small-scale operations only.

[1] Methyl, ethyl, propyl, or isopropyl.
[2] Composed of 3 parts (by weight) hydrochloric acid and 1 part (by weight) nitric acid.
[3] To be handled by experienced personnel only.

b. Radiological Decontamination Equipment. Chemical Corps equipment used in radiological decontamination includes the 200- and 400-gallon power-driven decontaminating apparatus, portable water heater, and decontaminating brushes. Radiological decontamination equipment is listed below.

Item	Use	Item	Use
Broom	Brushing dust from personnel, clothing, equipment, and surfaces.	Bulldozer	Large-scale removal, burial, or other disposal of contaminated objects.
Brush	Scrubbing and brushing (same as for broom).	Power-driven decontaminating apparatus.	Large-scale hosing and spraying of vital areas, buildings, vehicles, and machinery.
Shovel	Removal, burial, or other disposal of contaminated objects and materials.	Long-handled scraper	Scraping paint.
Hot water heater	Heating water for cleaning operations.	Steam jenny	Cleaning complicated machinery and greasy or hard dirt film surfaces.
Fire or garden hose	Hosing and scrubbing operations; also for use with bulldozer or road grader in holding down dust.		

c. *Radiological Decontamination Methods.* See chapter 4 of TM 3–220 for further information.

Method	Surfaces	Action	Technique	Advantages	Disadvantages
Water washing.	All nonporous surfaces (metal, paint, plastic). (Not suitable for porous materials such as wood, concrete, and canvas.)	Acts as a solvent and erodes. Action faster if water is hot.	For gross decontamination use water shot from high pressure hose. Work from top to bottom to avoid recontamination and from upwind to avoid spray. Spray from distance of 15 to 20 ft. Use 30° to 45° angle on vertical surfaces. Determine cleaning rate if possible, or use a rate of 4 sq ft per minute.	All water equipment may be utilized. Allows operation to be carried out from a distance. Contamination may be reduced by 50 percent. Most readily available agent.	Drainage must be controlled. (Runoff is contaminated and requires disposal.) Carries contaminant into porous materials. Not applicable on dry contaminated surfaces (use vacuum) or oiled surfaces.
Using detergent solution.	Nonporous surfaces (especially films).	Emulsifying agent. Wetting agent. (Action faster if solution is hot.)	Rub surface 1 minute and wipe with dry rag; use clean surface of the rag for each application. (Moist application is all that is desired.) Do not allow solution to drip onto other surfaces. Solution may be applied with a powered rotary brush or from a distance by use of pressure sprays.	Dissolves films which hold contamination. Contamination may be reduced by 90 percent. Easily handled. More efficient than water alone.	Requires close contact with surface. Not efficient for long-standing contamination. Runoff requires disposal.
Steaming.	Nonporous surfaces (especially painted or oiled surfaces).	Solution and erosion.	Work from top to bottom and from upwind. Clean surface at a rate of 4 ft per minute. The cleaning efficiency of steam may be greatly increased by use of detergents.	Reduces contamination by about 90 percent on painted surfaces. Corps of Engineers steam jenny can be used.	Runoff requires disposal. Waterproof clothing necessary. Requires special equipment.
Scrubbing.	Porous and nonporous surfaces.	Physical removal of contaminant.	Use in conjunction with other processes.	Used on "hot spots" following other processes. May be used on small objects and areas.	Slow and laborious. Erosive action on some surfaces.
Using complexing agents.	Nonporous surfaces.	Forms soluble complexes with contaminant.	Use 3 percent (by weight) solution. Spray solution on surface. Keep surface moist 30 minutes by spraying periodically, then flush with water. One gal. of solution decontaminates about 150 sq ft of surface.	Holds contamination in solution. Reduces contamination of unweathered surfaces by 75 percent in 4 minutes. Solution can be prepared in tank of power-driven decontaminating apparatus. Solution easily stored and	Requires application for 5 to 30 minutes. Little penetrating power. Little value on weathered surfaces.

			Mix equal parts with mechanical foam for use on vertical and overhead surfaces.	used.	
Using caustic solution: Sodium hydroxide (lye), calcium hydroxide, potassium hydroxide.	Painted surfaces	Removes paint	Allow solution to remain on surface until paint softens, then wash off with water; remove remaining paint with long-handled scrapers. 1 lb of caustic of 2½ gal. of water removes about 100 sq ft of paint; the addition of 1½ lb of trisodium phosphate aids in removal; the addition of 3 oz of cornstarch holds solution to surface.	Time of contact varies with contaminated surface—15 minutes to 2 hours. Can be prepared in steel tank of power-driven decontaminating apparatus.	Can cause severe burns; destroys body tissue. Corrosive to aluminum or magnesium surfaces. Not recommended for vertical or overhead surfaces.
Using trisodium phosphate solution.	Painted surfaces	Removes paint	Apply hot 10-percent solution. When paint softens, flush from surface with water. Repeat as necessary.	Reduces activity to tolerance in 1 or 2 applications. Fast acting.	Solution harmful to body tissue. Powder harmful if inhaled. Corrosive to aluminum or magnesium surfaces.
Using organic solvents: Kerosene, gasoline, alcohol, turpentine, acetone, ether, commercial paint remover.	Nonporous surfaces (greasy or waxed surfaces, paint or plastic finishes).	Dissolves oil and other organic materials. Also removes paint.	Immerse object in solvent or wipe with solvent. Wash in hot soapy water, then rinse in clear water.	Quick dissolving action. Recovery of solvent possible by distillation.	Vapors are toxic. Good ventilation required. Fire precautions required.
Using inorganic acids: Hydrochloric acid, sulfuric acid.	Metal surfaces, especially those with porous deposits (rust or calcareous growth); circulatory pipe systems.	Strong dissolving action on metals and porous deposits.	Use dip-bath technique for movable objects. Keep acid at a concentration of 1 to 2 normal (9 to 18 percent hydrochloric acid, 3 to 6 percent sulfuric acid). (Reaction time on weathered surfaces should be 1 hour; on pipe systems, 2 to 4 hours.) Flush surface with water, neutralize or wash with hot soapy water, and then flush with water again.	Rapid dissolving action.	Vapors are toxic. (Good ventilation required.) Liquid is harmful to the skin. Acid solutions should not be heated. Rust inhibitor required to prevent corrosion. Trained personnel required. Special equipment required.
Using acid mixtures:	Nonporous surfaces, especially those having	Dissolving action.	Use same as inorganic acids. Mixture consists of 1/10 gal.	Dissolving action may reduce contamination of	Weathered surfaces may require prolonged treatment.

c. Radiological Decontamination Methods—Continued

Method	Surfaces	Action	Technique	Advantages	Disdavantages
Hydrochloric acid or sulfuric acid with acetates or citrates.	porous deposits; circulatory pipe systems.		of hydrochloric acid, 1/5 lb of sodium acetate, and 1 gal. of water. Keep surface wet for 1 hour, then flush with water.	unweathered surfaces by 90 percent in 1 hour. Removes rust.	Harmful to personnel.
Vacuum blasting.	Porous and nonporous surfaces.	Physical removal of contaminated surfaces.	Run unit over contaminated surface.	Safe and rapid. Contaminant controlled.	Wears away surfaces. Protective mask required.
Sandblasting.	Nonporous surfaces.	Physical removal of contaminated surfaces.	Wet sand prior to sandblasting. Keep removed material wetted down.	Satisfactory method for nonporous surfaces. Can be used for large-scale operations.	Wears away surfaces. Not feasible for porous surfaces. Spreads contamination. Protective mask and hood required.
Sanding, filing, grinding, planing, chipping.	Porous and nonporous surfaces.	Physical removal of contaminated surfaces.	Remove surface and control residue.	Reduces "hot spots."	Practical for small areas or objects only. Time-consuming. Protective mask and gloves required.
Using earth-moving operations.	Soil and loose rock.	Physical removal of contamination.	Remove contamination with bulldozers, road graders, and similar equipment.	Work may begin quickly--- Tools or equipment usually available. Reduces hazard quickly (if bulldozers are used).	Limited control of contaminated dust. Disposal problem may become acute. Equipment may become contaminated. Protective mask should be worn.
Brushing-------	Porous and nonporous surfaces.	Physical removal of loose contaminated dust.	Brush dust from surface.	Work may begin quickly--- Rapid action. Brushes usually available.	Limited control of contaminated dust. Little or no removal of dust within pores of many porous surfaces. Protective mask should be worn.
Vacuum cleaning.	Dry contaminated surfaces.	Removal of contaminated dust by suction.	Use conventional vacuum technique with efficient filter.	Rapid---------- Good on dry, porous surfaces. Water not required. Contamination controlled.	All dust must be removed from exhaust system. Machine may become contaminated. Rubber gloves required for disposal of waste and filters.

d. Radiological Decontamination. Radiological decontamination data for various items are presented below. See TM 3–220 for additional information on radiological decontamination.

Radiological Decontamination

Item	Method	Equipment or decontaminant	Remarks
Clothing	Vacuum clean	Vacuum cleaning machinery.	Dispose of contamination removed by machine filter.
	Wash	Laundry [1]	Dispose of water used for washing and rinsing.
Equipment	Depends on nature of surface.		*b* and *c* above.
Buildings	Abrasions, caustics		*b* and *c* above.
Terrain	Removal	Bulldozers, road grading equipment.	
	Decay	None	Wait for natural decay. See *b* above.
Water	Filter	Filters, stills, and purifiers (engineer equipment).	See FM 3–12, Operational Aspects of Radiological Defense.
Food, cooked	None; dispose of, isolate, or shield.	Digging equipment	Not safe or practicable to attempt to remove radiological contamination from cooked food. See FM 3–12, Operational Aspects of Radiological Defense.
Food, covered	Scrub or wash	Brushes or hose	See FM 3–12, Operational Aspects of Radiological Defense.
Food, exposed	Peeling or paring. *DO NOT WASH.*	Knife	See FM 3–12, Operational Aspects of Radiological Defense.
Personnel	Bathing, scrubbing, showering, washing.	Brushes, hose, showers, soap.	Bathing and scrubbing must be continued until contamination is lowered to a safe level.

[1] See TM 3–220 for details.

e. Radiological Disposal Methods. See TM 3–220 for additional information.

Method	Technique	Type of material or area
Wrecking	Use cutting torches and standard wrecking equipment. When possible, handle by remote control. Use minimum number of personnel. Keep contaminated material in a moistened condition to reduce dust hazard.	Combustible, inert, and fusible materials.
Controlled burning	Use an incinerator which will adequately control the ash. Monitor and dispose of ashes as concentrated noncombustible material. (Bulk is reduced to about 1 percent of original.) Use filter to reduce airborne hazard.	Combustible material.
Burial on land	*For temporary burial.* Select an area as close to contamination as practicable. Make use of natural depressions. Avoid locations having heavy runoff of water and underground water near the surface. Cover with at least a 6-ft layer of earth. *Additional requirements for permanent burial.* Select an area with solid packed earth. Prepare burial cell (or vault) as follows: line with concrete, waterproof, fill to within 6 ft of surface only, then fill to top with earth, cap with concrete roof and seal, and cover adequately with earth. Position wells alongside to provide for periodic monitoring.	Areas that are remote from sea and that have no natural entombment sites. Clay substrata is preferable. If possible, do not select substrata composed of sand or rock.

e. Radiological Disposal Methods—Continued

Method	Technique	Type of material or area
Entombment	Place material in leakproof containers and position as high as possible in the mine or cave to provide a dry atmosphere. Treat containers to prevent corrosion. Seal off entrance.	Land areas with natural entombment sites.
Burial at sea	Place material in reasonably strong and leakproof containers, preferably of concrete. Fill completely (by adding water if necessary), seal, and then sink in deep water (1,000 fathoms or more, not less than 10 miles from shore).	Areas close to large bodies of water.
Sumps	Dig trenches to one or more large sumps that are located away from traffic. Mark well. Dig sumps at least 8 ft deep. Never fill to more than 3 ft from top. Avoid locations having heavy runoff of water and underground water near the surface.	Areas that are remote from sea and that have no natural entombment sites. Clay substrata is preferable. If possible, do not select substrata composed of sand or rock.

5.6. Personnel Decontamination Stations

Field-type personnel decontamination stations should be established to provide facilities for decontamination of personnel who have become contaminated with CBR agents. For detailed procedures and description of station, see FM 21–40 and FM 21–48.

Section II. CLOTHING IMPREGNATION

5.7. References

For information on chemical impregnation of clothing, see FM 3–85, TM 3–281, and TM 3–303.

5.8. Operating Data

a. General. The chemical processing company is equipped with two clothing impregnating plants, each capable of processing approximately 4,000 pounds (600 uniforms) per 24-hour day. Each uniform is considered to consist of a pair of full long underwear, a pair of socks, a pair of fabric gloves, and a one-piece or two-piece herringbone twill outfit. Chemical processing units usually operate in conjunction with quartermaster laundry units.

b. Clothing Impregnating Plant. The M2A1 and M2 clothing impregnating plants employ aqueous suspension impregnation methods.

(1) *Operating supply requirements.* The weight and storage space requirements for operating supplies needed to impregnate approximately 4,000 pounds of clothing during a 24-hour operating day are shown below.

Supplies Required for 24-Hour Day Operation of M2A1 or M2 Impregnating Plant

Item	Gross weight (lb)	Floor space (sq ft)	Volume (cu ft)	Remarks
Boiler water (400 gallons)	3,342			3,000-gallon canvas tank (11-foot diameter) normally is used.
Chlorinated paraffin	660	12.0	23.4	In 55-gallon drums stored on side, 2 drums high.
72 octane gasoline (fuel for 2 electric generators).	770	12.0	36.0	In 55-gallon drums stored on side, 2 drums high.
No. 3 fuel oil (for steam generator).	2,360	18.0	60.0	In 55-gallon drums stored on side, 2 drums high.
Impregnite, XXCC3	850	8.5	27.0	In metal containers, 16 inches in diameter and 26 inches high, stored on side, 2 containers high.
Polyvinyl alcohol, granular	32	3.0	3.3	In 120-pound drums 16 inches in diameter and 30 inches high, stored on side.

(2) *Laboratory material requirements.* Monochlorobenzene and tetrachloroethane are shipped in 55-gallon drums and are stored at a safe distance from the generators. The quantities of laboratory materials required for a 24-hour day operation of processing 4,000 pounds of clothing are listed in (4) below.

(3) *Lubricant requirements.* The lubricants required for the M2A1 or M2 impregnating plant include oil (usually supplied in 55-gallon drums) and grease (usually supplied in 10-pound pails). The quantities required for a 24-hour day impregnation of 4,000 pounds of clothing are listed in (4) below.

(4) *M2A1 or M2 impregnating plant laboratory material and lubricant requirements.*

Item	Reagent or lubricant	Quantity required for 4,000-pound output per 24-hour day
Reagent or material	Acetic acid, glacial, CP	8.3 liters.
	Monochlorobenzene	9 gallons.
	Potassium iodide crystals	1.8 pounds.
	Sodium thiosulfate crystals	0.83 pound.
	Sodium thiosulfate fixanal	0.25 carton.
	Stopcock grease	Very small amount.
	Tetrachloroethane	1.8 gallons.
Lubricant	Lubricating grease	3.2 ounces.
	Lubricating oil	5.5 gallons.

5.9. Plant Layout

The covered shop (floor area) requirements for an M2A1 or M2 impregnating plant are approximately 5,200 square feet.

5.10. Emergency Impregnating Equipment

a. General. The M1 field clothing impregnating outfit and the M3 field clothing impregnating set are designed for emergency use by troops in the field when the facilities of a clothing impregnating plant are not available. During periods of emergency, quartermaster laundry units (mobile) may be utilized for initial impregnation and reimpregnation, using the operating procedures outlined in appropriate technical manuals (AR 700–62).

b. Testing Kit. The M2 impregnite-in-clothing testing kit is used to determine whether permeable clothing contains sufficient impregnite to afford the wearer protection against blister agents.

c. Characteristics of Emergency Impregnating Equipment.

Item	Dimensions (in.)			Weight (lb)	Volume (cu ft)	Remarks
	Length	Width	Height			
M1 impregnating outfit	28	13½	13½	72	2.9	1 outfit per box; mixing time 60–80 minutes;[1] capable of impregnating 30 (2-layer) uniforms.
M3 impregnating set	23½	11½	11½	53	1.7	1 set per box; mixing time 20 minutes[1]; capable of impregnating 20 (2-layer) uniforms.
ABC–M2 impregnite-in-clothing testing kit.	17½	13½	7¼	23	1.0	60 per carton.

[1] Drying time also required. The length of the drying time will depend on the weather. Do not dry in direct sunlight.

Section III. CHEMICAL LABORATORY SERVICE

5.11. References

For information pertaining to the chemical laboratory, see FM 3–85 and TM 3–215.

5.12. Operating Data

a. Laboratory Services. The services which may be performed for various branches of the Army and for the Air Force and Navy by chemical laboratories are listed below.

Chemical Laboratory Services

Agency for which service is performed	Service performed
Chemical Corps	Collection and identification of enemy chemical and radiological agents and collection of enemy biological agents.
	Determination of adequacy of protective equipment.
	Provision of methods of emergency decontamination and protection against new chemical and radiological agents.
	Provision of miscellaneous technical advice.
Air Force	Analysis of material for indications of sabotage.
	Investigation of corrosion inhibitors.
	Tests of cleaning mixtures.
	Tests of cooling liquids for aircraft.
	Tests of parachute material.
Corps of Engineers	Analysis of water and concrete.
	Study of problems of photo processes.
Army Medical Service	Analysis and testing of insecticides.
	Determination of purity of solvents.
	Examination of water and foods for toxic contamination.
	Identification of drugs.
	Supplementary analyses of blood and urine.
Military Intelligence	Investigation and evaluation of foreign materiel.
Ordnance Corps	Analysis of sludges from motors.
	Analysis of soldering flux.
	Examination and testing of detonators.
	Examination and testing of explosives.
	Examination and testing of primers.
	Examination and testing of propellants.
Quartermaster Corps	Analysis of various substances.
	Development of insect powders, sunburn creams, windburn salves.
	Tests on stored tentage and clothing.
	Examination of dyes.

b. Surveillance. Typical surveillance procedures accomplished by chemical laboratories are shown below.

Chemical Laboratory Surveillance Procedures

Test	Test Method	Time required for test	Personnel required for test
Effect of agent on humans	Hematology	30 min	1
	Urinalysis	45 min	1
Effect of agent on rats	Pathology	1 hr	1
Canister ammonia evolution	Physiological	3 hr	2
	Analytical	2 hr	2
Canister gas life	Agent filtration	4 hr	2
Canister smoke penetration	Standard smoke filtration	1 hr	2
Canister resistance	Pressure drop	30 min	1
Canister water content	Weight gain	5 min	1
	Air drying	6 hr	1
	Heat absorbent sample	3 hr	1
Impermeable vesicant resistance	Penetration to indicator	7 hr	2
Lung irritant action	Gas chamber	10 days	1
Penetration of protective material	Standard drop	48 hr	1
	Vapor cup	48 hr	1
Permeable fabric available chlorine	Analytical	1 hr	1
Permeable fabric vapor resistance	Filtered vapor through bubbler-indicators	4 hr	2
Shell-tapping	Drilling	1 hr	1
Skin irritability to various materials	Patch testing	48 hr	1
Vesicant action on skin	Rod	72 hr	1
	Vapor cup	72 hr	1
	Solution	72 hr	1

CHAPTER 6

RADIOLOGICAL DEFENSE

Section I. EQUIPMENT AND RADIOACTIVE SOURCES

6.1. Radiac Instruments[1]

Item	Capability	Serviceability standard	Battery requirements
AN/FJW–1(V) radiation detection alarm system.	Nuclear burst detection	NA	NA.
AN/PDR–27J radiac set (AN/PDR–27A through I are standard B) (IM–141).	Measure gamma dose rate; detect presence of beta.	±10%	6 ea BA–30.
AN/PDR–39 radiac set (standard B)	Measure gamma dose rate	±15%	2 ea BA–51. 1 ea BA–42. 1 ea BA–1278/U. 1 ea BA–1277/U.
AN/PDR–54 radiac set (standard B) (IM–154).	Measure alpha dose rate alone or in the presence of beta and gamma.	±10%	2 ea RM–42 Mallory. 2 ea RM–3 Mallory.
IM–9/PD radiacmeter	Measure total gamma and X-ray dose.	±5%	None.
IM–93/UD radiacmeter	Measure total gamma dose	±5%	None.
IM–174/PD radiacmeter (formerly IM–108/PD).	Detect and measure gamma dose rate.	±10%	2 ea BA–1318/U. 1 ea BA–1288/U.
IM–147/PD radiacmeter	Detect and measure gamma dose rate.	±10%	None.
IM–156( )/PD radiacmeter (formerly part of radiac set AN/PDR–53).	Detect and measure alpha, beta, and gamma dose rates. Intended for alpha surveys.	±20% @ 5.1 MEV.	4 ea BA–261. 2 ea BA–1328/U. 2 ea TR–115.
PP–1578A/PD charger, radiac detector.	Used to charge pocket dosimeter such as radiacmeters IM–9, IM–93, and IM–147.	NA	None.
TS–784( )/PD radiac calibrator	Calibrator for radiacmeters AN/PDR–27, AN/PDR–39 and IM–174.	NA	None.
Air sampler (Staplex Model TF 1A–4)	Air sampling at nuclear incident sites.	NA	24V DC.
Air sampler (Staplex Model TF 1A)	Air sampling at nuclear incident sites.	NA	No batteries; instrument requires 110V AC.
Portable pulse counter (Eberline Model PPC–2).		NA	
Tripod	Mount for air samplers	NA	NA.

[1] For basis of issue and authorized allowances, see applicable TOE and TA.

6.2. Characteristics of Radioactive Source Sets and Test Samples*

Item and model	Description	Service or branch resp	Standard	Sealed source	Primary radiation type	Activity	Isotope	Half-life
Radioactive check source.	Small pinpoint of source in brass carrier of AN/PDR–39 radiac set. NOT TO BE REMOVED.	Army Signal Corps	------	Yes----	β	Unk---	Sr^{90}----	25 yr-----
Radioactive test sample, MX–1083/PDR–27.	Plastic rod 3/8 in. x 5 in. Purple in color on one end containing radioactive material.	Army Signal Corps (Note 7)	A	Note 1-	γ	5μc----	Co^{60}---	5.3 yr-----
Radioactive test sample, MX–1083B/PDR–27 MX–1083C/PDR–27J.	Same as MX–1083/PDR–27.	Army Signal Corps (Note 7)	B	Note 2-	γ	7μc----	Ra^{226}---	1,620 yr---
Radioactive test sample, M1.	Small disk 1 in. x 5/16 in. with the Co^{60} as a coating on a thin copper disk.	Army Cml Corps	B	No----	γ	1μc----	Co^{60}---	5.3 yr-----
Radioactive test sample, M2.	Small disk source holder 1 in. x 5/16 in. with Pb^{210} as a coating on a thin copper disk.	Army Cml Corps	B	Yes----	β	<1μc--	Pb^{210}--- Ra^{226}	22 yr-----
Radioactive test sample, M3.	Small stainless steel disk 2 1/3-in. x 0.01 in. thick, coated on one side with U_3O_8.	Army Cml Corps	B	Yes----	α	25,000 ±20% cpm	U_3O_8	NA------
Radioactive test sample, M4.	Stainless steel disk with a coating of U_3O_8 on one side. Disk is 1 in. x .015 in.	Army Cml Corps	B	Yes----	α	6,000 ±20% cpm	U_3O_8	NA------
Radioactive test sample, M5.	Stainless steel disk 1 1/4 in. x .015 in. thick, coated on one side with U_3O_8.	Army Cml Corps	B	Yes----	α	3,000 ±20% cpm	U_3O_8	NA------
Radioactive source, M6.	Stainless steel retainer 1 3/16 in. diam at large end, 5/16 in. diam at small end, and 1 1/8 in. long. Source is in large end.	Army Cml Corps	A	No----	β	25–40 mc	Sr^{90}--- Y^{90}	25 yr-----
Radioactive test sample, M7.	Steel plate 5 1/4 in. x 4 in. x 1/16 in. with a U_3O_8 coated area on one side; 4 5/8 in. x 3 in. with a raised metal frame on contaminated side.	Army Cml Corps	A	Yes----	α	100,000 ±20% cpm	U_3O_8	NA------
Radioactive test sample, MX–1173/UD.	Consists of handling arm, source, lead pig, and frame. The source is stored in the lead container which is 3 1/2 in. x	Army Cml Corps	B	Yes----	γ	1 mc---	Co^{60}---	5.3 yr-----

See definitions and notes at end of table.

Regulated by AEC	Regulated by Surgeon General	Lifetime control required	Quantitative control required	Publications regarding	Use	Basis of issue	Remarks
Yes	Yes	Yes	NA	TM 11-487J	Used to check operation of ion chamber on AN/PDR-39 by directing beta particles directly into chamber.	One per AN/PDR-39 or -39A radiac instrument.	
Yes	Yes	Yes	NA	TM 11-487J TM 11-5543 TB CML 54	Used to determine whether radiac set AN-PDR-27 is functioning properly. Also used for training.	One per AN/PDR-27 in lieu of MX-1083B/PD.	Note 1. Note 7.
No	Yes	Yes	NA	TM 11-487J TM 11-5543 TB CML 55	Same as MX-1083/PDR-27.	One per AN/PDR-27.	Note 2. Note 7.
Yes	Yes	Yes	NA	TB CML 66	Used as a source of gamma radiation for test purposes.	None	
No	No	No	No	TB CML 65	Used as a source of beta radiation for test purposes.	None	
No	No	No	No	TB CML 53	Used with IM-156( )/PD to determine if meter is operating. Also used for training. Alpha source only.	Per AN/PDR-63 until issue of M7.	
No	No	No	No	TB CML 64	Used as a test source of alpha radiation.	None	
No	No	No	No	TB CML 62	Used as a test source of alpha radiation.	None	
Yes	Yes	Yes	NA	TB CML 52 SB 11-477	Used to calibrate standard radiac instruments such as the IM-174/PD and AN/PDR-27J.	One per TS-784 or TS-784A/PD. Radiac calibrator NOT TO BE REMOVED.	Note 3.
No	No	No	No	TB CML 63 TM 11-6665-207-12	Used with radiacmeter IM-156( )/PD as a check source to determine if meter is operating. Also used for training.	Per IM-156 ( )/PD.	
Yes	Yes	Yes	NA	SB 11-206 MWO CML 30	Used to calibrate extremely low dose rate instruments and for training. Approx 135 mrad/hr at 10 cm.	None	

6.2. Characteristics of Radioactive Source Sets and Test Samples*—Continued

Item and model	Description	Service or branch resp	Standard	Sealed source	Primary radiation type	Activity	Isotope	Half-life
	4 in., cylinder shaped. The handling arm screws into the source to withdraw from pig.							
Calibrator, radiac, TS–1230.	Same as the M7 source. See Note 4.	Army Cml Corps	A	No	α	Note 4.	Pu^{239}	24,300 yr.
Radioactive source set, M3.	Consists of source set (pig and source) tongs and two boxes. One box for tongs and one for source. Total weight 170 lb and volume 5.15 cu ft. Source box is approx 18 in. x 18 in. x 18 in.	Army Cml Corps	A	Yes	γ	100 mc	Co^{60}	5.3 yr
Radiac calibrator set, AN/UDM–1.	A very large and heavy device weighing 1,025 lb and occupying 48.76 cu ft. Consists of a source chamber, a track to support the chamber, a positioning carriage, a carriage track, and an optical system.	Navy Buships	B	Yes	γ	100 c	Co^{60}	5.3 yr
Radiac calibrator set, AN/UDM–1A.	Same as AN/UDM–1.	Navy Buships	A	Yes	γ	100 c	Cs^{137}	37 yr

Definitions of Symbols:

c	Curie	Y^{90}	Yttrium 90
mc	Millicurie	Ra^{226}	Radium 226
μc	Microcurie	Pb^{210}	Lead 210 (Radium D)
cpm	Counts per minute	U_3O_8	Uranium oxide
dpm	Disintegrations per minute	Pu^{239}	Plutonium 239
<	Less than	Cs^{137}	Cesium 137
NA	Not applicable	α	Alpha (particle) emitter
Co^{60}	Cobalt 60	β	Beta (particle) emitter
Sr^{90}	Strontium 90	γ	Gamma (ray) emitter

Notes.

1. This source prior to 20 May 1959 was not sealed. Those after 20 May 1959 are sealed sources.
2. This source prior to 3 June 1959 was not sealed. Those after 3 June 1959 are sealed sources.

Regulated by AEC	Regulated by Surgeon General	Lifetime control required	Quantitative control required	Publications regarding	Use	Basis of issue	Remarks
Note 5.	Yes	Yes	NA	TM 11–6665–207–12 TB SIG 346	Used for calibration of alpha instruments such as IM–156( )/PD, AN/PDR–54, and AN/PDR–60.	One per radiacmeter, IM–156 ( )/PD.	Note 4. Note 5.
Yes	Yes	Yes	NA	TM 3–6665–207–12	Used for calibration of low dose rate instruments measuring gamma radiation. Also used for training.	One per division.	
Yes	Yes	Yes	NA	TM 11–1176	Used to calibrate radiac instruments of both low and high range and the TS–784( )/PD radiac calibrator.	Navy unk	
Yes	Yes	Yes	NA	TM 11–1176	Same as for AN/UDM–1.	Navy unk	Note 6.

3. The radiac calibrator TS–784/PD or TS–784A/PD source M6 is a component of the set, not to be removed under any circumstances. This source is extremely hazardous.
4. This source contains 6.4μc of Pu^{239} and is designed to have a total surface alpha activity of 7,100,000 $\pm$2% counts per minute, or roughly 14,200,000 dpm. The calibrator is equipped with two attenuator masks. Mask A reduces plate by a factor of 6 and Mask B by a factor of 60. The combination reduces by a factor of 100.
5. The TS–1230 is not a sealed source and must not be touched on the contaminated surface because of the hazard of ingested alpha emitters. Observe instruction and warnings before using the source.
6. The UDM–1 uses Co^{60} with a gamma energy of 1.26 MEV. The UDM–1A uses Cs^{137} with an energy of .66 MEV. The .66 MEV is close to the average energy of fallout, and the 1.26 is not. Whenever possible the Cs^{137} should be used or a conversion should be determined for the particular instrument involved.
7. Also Navy issue.

*For serviceability standards, see SB 3–30–300.

6.3. Calibration of Radiac Instruments[1] [2]

Instrument	Serviceability standard	Calibration device	Calibration point(s)	Reference publications (calibration)	Approximate time required per instrument
IM-174/PD	±10%	UDM-1 or UDM-1A[3]	2, 10, 50, 200, 400 rad/hr	None	15 min.
		TS-784/PD	3, 30, 300 rad/hr	TM 11-6665-204-12 SB 11-477.	10 min.
		TS-784A/PD (check serviceability only).	3, 40, 350 rad/hr	TM 11-6665-204-12 SB 11-477.	10 min.
AN/PDR-39	±15%	UDM-1 or UDM-1A	4, 40, 400, 4K, 40K mrad/hr	TM 11-5514A	30 min.
		M3 source set	4, 40, 400 mrad/hr, lower scales only.	TM 3-6665-207-12	40 min.
		TS-784/PD	4, 40, 400, 4K, 40K mrad/hr	TM 11-6665-204-12	20 min.
		TS-784A/PD	40, 400, 4K, 40K mrad/hr	TM 11-6665-204-12	20 min.
AN/PDR-27J	±10%	UDM-1 or UDM-1A	.4, 4, 40, 400 mrad/hr	TM 11-6665-209-15	20 min.
		M3 source	.4, 4, 40, 400 mrad/hr	TM 3-6665-207-12	30 min.
		TS-784/PD	.45, 4.5, 45, 400 mrad/hr[4]	TM 11-6665-204-12	15 min.
		TS-784A/PD (appropriate charts must be issued).	.45, 4.5, 45, 400 mrad/hr[4]	TM 11-6665-204-12	15 min.
IM-156( )/PD (SRJ-6)	±20%[5]	TS-1320( )/PD	5, 25, 50, 3000 mrad/hr	TM 11-6665-207-12	30 min.
IM-154 (AN/PDR-54) (PAC-3G).	±15%	TS-1230( )/PD	( )[6]	TB Cml 77	30 min.
IM-170 (AN/PDR-60) (PAC-1S, 1SA).	±5%	TS-1230( )/PD	( )[6]	TB Cml 77	30 min.
TS-784/PD[7]	NA	UDM-1A	4, 40, 400, 40K mrad/hr	TM 11-6665-204-12 TB CML 52.	1 hr. 15 min.
TS-784A/PD[7]	NA	UDM-1A	40, 400, 40K mrad/hr	TM 11-6665-204-12	1 hr. 15 min.

[1] In most cases a screwdriver will be necessary for calibration in addition to the calibration device. The AN/PDR-27 instruments require an additional special tool in addition to the screwdriver and calibration device.

[2] Personnel required: safety officer and operator. Not more than 5 operators per safety officer. Safety officer must be qualified by Lexington Signal Depot through special instruction.

[3] Due to the different energy levels of the Gamma from UDM-1 (1.25 MEV) and UDM-1A (.66 MEV), there will be a difference in calibration. The UDM-1A should be used when possible to more closely approximste fsiiout energy average.

[4] When the long black glass BS-2 tube is used, the high reading will be 150 mrad/hr instead of 400 mrad/hr.

[5] In the case of alpha instruments there is no "check"; therefore, no present accuracy is given. In the case of some alpha instruments, the accuracy given is for needle fluctuation or balancing of potentiometers against various scales.

[6] Adjusted to probe area and TS-1230( )/PD activity counts per min.

[7] The TS-784 and TS-784A are secondary standards calibrated against primary standards UDM-1 and UDM-1A.

Section II. RADIOLOGICAL SAFETY (TECHNICAL)

See TC 3–12, Nuclear Accident Contamination Control for additional information

6.4. Standards for Protection

References:

Paragraph 20.101, Title 10, Part 20, Code of Federal Regulations.
Paragraph 20.106, Title 10, Part 20, Code of Federal Regulations.
AR 40–580.
AR 40–582.
TB MED 254.

6.5. Formulas for Concentration of Radioactive Isotope

Determination of Airborne Long-Lived Activity.

1. To determine the counts per minute due a long-lived airborne radioisotope, the following equation is used:

$$C_{LL}=\frac{C_2-C_1 e^{-\lambda\Delta t}}{1-e^{-\lambda\Delta t}}$$

where: C_{LL}=counts per minute of long-lived material (greater than 24 hours).
C_2=second count of collected air sample (normally taken 24 hours after original count).
C_1=original count of collected air sample (normally taken 4 hours after collection).
λ=decay constant of thoron (equals 0.0655).
t_1=time original count was taken (in hours).
t_2=time second count of sample was taken (in hours).
Δt=difference between t_2 and t_1 (t_2-t_1).
e=base of natural logarithms (2.7183).

2. To convert counts per minute into disintegrations per minute per cubic centimeter (d/m/cc), the following equation is used:

$$d/m/cc=\frac{c/m}{V\times E_f\times E_c}$$

where: $d/m/cc$=disintegrations per minute per cubic centimeter.
c/m =counts per minute due long-lived material.
V =volume of air sampled in cubic centimeters.
E_f =efficiency of collector or filter.
E_c =efficiency of counter (geometry).

3. To convert disintegrations per minute per cubic centimeter into microcuries per cubic centimeter, the following is used:

$$d/m/cc\times 4.55\times 10^{-7}=\mu c/cc$$

where: $\mu c/cc$=microcuries per cubic centimeter.

6.6. Storage of Radioactive Material

Reference: AR 700–323.

6.7. Transportation of Radioactive Material

Reference: "Handbook of Federal Regulations Applying to Transportation of Radioactive Materials," May 1958.

6.8. Disposal of Radioactive Waste Material

References: Paragraph 20.301, Title 10, Part 20, Code of Federal Regulations and AR 755–380.

6.9. Marking of Storage and Contaminated Areas

Reference: Section IV, AR 385–30.

Section III. RADIOLOGICAL SURVEY

6.10. Air-Ground Correlation Factors

Height above ground (ft)	Aircraft						
	H-13 or HU-1	H-23	H-19	L-19	L-20	H-34	H-21
100	2.2	2.2	2.4	2.2	4.1	5.2	2.6
200	3.2	3.4	3.6	3.3	6.2	7.8	3.8
300	4.5	4.7	5.0	4.6	8.7	10.9	5.4
400	6.2	6.5	7.0	6.3	11.9	15.1	7.4
500	8.2	8.5	9.1	8.3	15.7	19.8	9.7
1,000	29.0	30	32	29	55	70	35
2,000	301	314	336	305	577	728	358
3,000	2,580	2,688	2,880	2,616	4,944	6,240	3,072

Notes.

1. To obtain ground dose rate, multiply air dose rate by the factor for the height and type of aircraft.
2. The air-ground correlation factors listed above are used as a guide only. Actual air-ground correlation factors should be computed when radiological surveys are conducted.

6.11. Location of Survey Meter During Aerial Survey

Aircraft	Survey meter location
HU-1A	On floor of passenger compartment in front of the second seat from the left side of the aircraft.
H-13	On floor directly behind right cyclic stick.
H-23	On floor in front of left seat between the cyclic stick and the antitorque pedals.
H-21	On floor of the passenger compartment in front of the seat at station 299.
H-19	On floor of the passenger compartment in front of the seat at station 136.
L-19	On the floor in front of the rear seat at station 61.
L-20	On the floor in front of right rear seat.[1]
H-34	On the floor at station 100 directly over the forward center cell inspection plate.[1]

[1] Assumes that the fuel tank under this location is full.

6.12. Aircraft Survey Capabilities

Order of preference	Type aircraft	Personnel required [1]	Average coverage per hour [2]	Hours w/o refueling [3]
H-13E	Helicopter	2		2 hr.
H-13H				3 hr. 30 min.
H-23D	Helicopter	2		3 hr. 30 min.
HU-1A	Helicopter	2		3 hr. 30 min.
H-19	Helicopter	2		3 hr. 30 min.
L-19	Fixed-wing	2		4 hr. 30 min.
L-20	Fixed-wing	2		4 hr.[4]
H-21	Helicopter	4		3 hr. 30 min.
H-34	Helicopter	4		3 hr. 30 min.

[1] Includes monitor.

[2] All aircraft have approximately the same area coverage capability of between 50 and 175 square miles per hour per aircraft, depending upon the degree of detail required and the degree of ground contamination.

[3] Load includes only required personnel.

[4] With full wing tanks, 5 hours 30 minutes.

6.13. Approximate Transmission Factors for Vehicles for Residual Gamma Radiation

Vehicle	Transmission factor
Armored personnel carrier (steel)	0.6
Tanks:	
Light	.2
Medium or heavy	.1
Trucks:	
¼-ton	.8
¾-ton	.7
2½-ton	.6
4- to 7-ton	.5

6.14. Vehicle Survey Capabilities

a. Refer to paragraph 6.13.

b. To reduce the dosage to personnel conducting the survey, vehicles which provide the most protection are used, depending on the type terrain, roads, bridges, obstacles that will be encountered, type vehicles available, and the tactical situation.

Section IV. SHIELDING

6.15. Approximate Transmission Factors for Structures for Residual Gamma Radiation

Building type[1]	Construction type			Floor of interest	Transmission factor
	Walls	Roof	Floors		
One-story building, 10 feet high.	Wood	Wood	Wood	1st floor	0.8
				Basement	.4
	Concrete	Wood	Wood	1st floor	.4
				Basement	.1
	Concrete	Concrete	Wood	1st floor	.03
				Basement	.01
One-story building, 20 feet high.	Wood	Wood	Wood	1st floor	.5
				Basement	.3
	Concrete	Wood	Wood	1st floor	.2
				Basement	.1
	Concrete	Concrete	Wood	1st floor	.03
				Basement	.01
One-story building, 40 feet high.	Wood	Wood	Wood	1st floor	.4
				Basement	.2
	Concrete	Wood	Wood	1st floor	.08
				Basement	.1
	Concrete	Concrete	Wood	1st floor	.03
				Basement	.01
Two-story building	Wood	Wood	Wood	2d floor	.9
				1st floor	.5
				Basement	.3
	Concrete	Wood	Concrete	2d floor	.7
				1st floor	.05
				Basement	.003
	Concrete	Concrete	Concrete	2d floor	.01
				1st floor	.02
				Basement	.0007
	None[2]	Concrete	Concrete	2d floor	----------
				1st floor	.4
				Basement	.02

[1] To determine the transmission factor for a particular structure, compute in accordance with appendix E, TM 3–225.

[2] Assume no walls where large window area exists.

6.16. Approximate Transmission Factors for Material

a. Initial Gamma Radiation, Common Materials. Approximate transmission factors for certain common materials are listed below.

Material	Density		Thickness											
	lb/ft³	g/cm³	Inches	0.5	1	2	4	8	12	16	20	24	28	32	36	40
			Centimeters	1.27	2.54	5.1	10.2	20.4	30.6	40.8	51.0	61.2	71.4	81.6	91.8	102
Steel	490	7.85		0.67	0.59	0.34	0.13	0.014	0.001	0.0002						
Concrete	144	2.31		.90	.83	.77	.67	.33	.17	.12	0.067	0.029	0.022	0.017	0.01	0.005
Earth	100	1.60		.93	.91	.84	.72	.50	.33	.25	.17	.13	.10	.08	.033	.025
Water	62.4	1.00		.95	.93	.91	.84	.63	.50	.435	.335	.27	.22	.20	.143	.111
Wood	34	.545		.98	.95	.93	.91	.84	.67	.56	.50	.46	.39	.33	.30	.27

b. Residual Gamma Radiation, Common Materials. Approximate transmission factors for certain common materials are listed below. For all other materials compute the density in pounds per cubic feet or grams per cubic centimeter and determine the approximate transmission factor from *c* below.

Material	Density		Thickness												
	lb/ft³	g/cm³	Inches--0.5	1	2	4	8	12	16	20	24	28	32	36	40
			Centimeters--1.27	2.54	5.1	10.2	20.4	30.6	40.8	51.0	61.2	71.4	81.6	91.8	102
Steel	490	7.85	0.55	0.35	0.14	0.023	0.0008								
Concrete	144	2.31	.80	.70	.50	.29	.11	0.037	0.013	0.005	0.002	0.0006	0.0003		
Earth	100	1.60	.90	.80	.60	.38	.18	.09	.042	.02	.01	.005	.003	0.001	0.0006
Water	62.4	1.00	.95	.85	.70	.55	.34	.20	.13	.09	.05	.035	.25	.015	.009
Wood	34	.545	.98	.95	.80	.70	.51	.39	.30	.25	.20	.15	.12	.09	.07

c. Residual Gamma Radiation, Other Materials.

Density		Thickness												
lb/ft³	g/cm³	Inches--0.5	1	2	4	8	12	16	20	24	28	32	36	40
		Centimeters--1.27	2.54	5.1	10.2	20.4	30.6	40.8	51.0	61.2	71.4	81.6	91.8	102
25	0.4	1.0	1.0	0.95	0.80	0.60	0.50	0.40	0.35	0.28	0.24	0.20	0.18	0.15
50	.8	.90	.80	.70	.60	.45	.28	.20	.15	.10	.07	.05	.035	.025
75	1.2	.88	.75	.65	.45	.28	.16	.09	.05	.03	.016	.009	.005	.003
100	1.6	.80	.70	.62	.40	.20	.09	.045	.02	.01	.005	.003	.0013	.0006
125	2.0	.78	.68	.52	.35	.14	.056	.021	.009	.0037	.0015	.0007	.0003	.0001
150	2.4	.75	.65	.47	.28	.095	.032	.01	.0038	.0017	.0005	.0002		
175	2.8	.72	.63	.42	.23	.07	.018	.0055	.0016	.0005	.0002			
200	3.2	.70	.60	.40	.18	.045	.009	.0025	.0006	.0002				
225	3.6	.68	.57	.37	.16	.03	.006	.0012	.0003	.0001				
250	4.0	.65	.55	.34	.14	.02	.004	.0007	.0001					
275	4.4	.63	.50	.31	.11	.015	.002	.0003	.0001					
300	4.8	.60	.48	.28	.09	.01	.0017	.0002						
325	5.2	.58	.45	.25	.08	.008	.0008	.0001						
350	5.6	.56	.42	.22	.06	.005	.0004	.0001						
375	6.0	.54	.40	.20	.05	.004	.0002							
400	6.4	.52	.38	.18	.048	.003	.0002							
425	6.8	.50	.36	.16	.04	.002	.0001							
450	7.2	.49	.35	.15	.03	.0014	.0001							
475	7.6	.48	.33	.14	.025	.0009	.0001							
500	8.0	.47	.31	.13	.02	.0007	.0001							

6.17. Shielding Calculations

a. Graphical Solution to Shielding Problems.

(1) Shielding problems can be worked by plotting a straight line on semilog graph paper. Dose rate is plotted along the vertical log axis and thickness of shielding material along the horizontal linear scale. The points along the straight line which are plotted are—

R_o = the original unshielded dose rate.

$\frac{1}{2}R_o$ = the dose rate when one half-thickness of shielding material is used.

$X_{\frac{1}{2}}$ = one half-thickness of shielding material.

R = the dose rate when any thickness (X) of shielding material is used.

X = thickness of shielding material used.

(2) The relationship of these points is shown in figure 3. Here the original dose rate (R_o) is 70 millirad per hour and the half-thickness ($X_{\frac{1}{2}}$) of the shielding material is 3 centimeters.

(3) When R_o is known, if two of the unknowns $X_{\frac{1}{2}}$, R, and X are known, the third unknown can be found. By using two shields of the same substance but different thickness, R_o can be found.

b. Mathematical Solution to Shielding Problems.

(1) Shielding problems can be solved mathematically, using the formula:

$$R=\frac{R_o}{2^n}$$

R represents the dose rate shielded by n half-thicknesses of material at a location where the unshielded dose rate is R_o; n is equal to X (thickness of shielding material used) divided by $X_{\frac{1}{2}}$ (one half-thickness of shielding material). This formula can also be rearranged as—

$$R_o=R\ (2^n)$$
$$n=1.44\ (1n\ R_o-1n\ R)$$

Sample problems:

(*a*) Find R. Given $R_o=2000$ rad/hr, $X=32$ cm, $X_{\frac{1}{2}}=4$ cm.

$$\frac{R_o}{R}=2^n \qquad \text{Where } n=\frac{X}{X_{\frac{1}{2}}}=\frac{32}{4}=8$$

$$\frac{2{,}000}{R}=2^8$$

$$R=\frac{2{,}000}{256}=\underline{7.8 \text{ rad/hr}}$$

(*b*) Find R_o. Given $R=8$ rad/hr, $X=16$ cm, $X_{\frac{1}{2}}=4$ cm.

$$\frac{R_o}{R}=2^n \qquad \text{Where } n=\frac{X}{X_{\frac{1}{2}}}=\frac{16}{4}=4$$

$$\frac{R_o}{8}=2^4$$

$$R_o=8\times16=\underline{128 \text{ rad/hr}}$$

(*c*) Find X. Given $R_o=75$ rad/hr, $R=15$ rad/hr, $X_{\frac{1}{2}}=2$ cm.

$$n=1.44\ (1n\ R_o-1n\ R)$$
$$n=1.44\ (4.3175-2.7081)$$
$$n=1.44\times1.6094$$
$$n=2.3175$$
$$n=\frac{X}{X_{\frac{1}{2}}}$$
$$X=n\times X_{\frac{1}{2}}$$
$$=2.3175\times2$$
$$=\underline{4.6350 \text{ cm}}$$

(*d*) Find $X_{\frac{1}{2}}$. Given $R_o=100$ rad/hr, $R=25$ rad/hr, $X=6$ cm

$$n=1.44\ (1n\ R_o-1n\ R)$$
$$n=1.44\ (4.6052-3.2189)$$
$$=1.44\times1.3863$$
$$=2$$
$$X_{\frac{1}{2}}=\frac{X}{n}=\frac{6}{2}=\underline{3 \text{ cm}}$$

(2) For field use the mathematical solution can be used by referring to the 2^n values listed in paragraph 6.22. Paragraph 6.22 eliminates the necessity of using logarithms or a slide rule.
Sample problems:

(*a*) Same as (1) (*a*) above.
(Worked the same way, except the 2^n value of 2^8 is obtained from the table by entering the n column at 8 and reading the value of 256 under the 2^n column).

(*b*) Same as (1) (*b*) above.
(Worked the same way, except the 2^n value of 2^4 is obtained from the table by entering the n column at 4 and reading the value of 16 under the 2^n column).

(*c*) Same as (1) (*c*) above.

1. $R=\frac{R_o}{2^n}$ $\quad 2^n=\frac{R_o}{R}$ $\quad \frac{75}{15}=5$

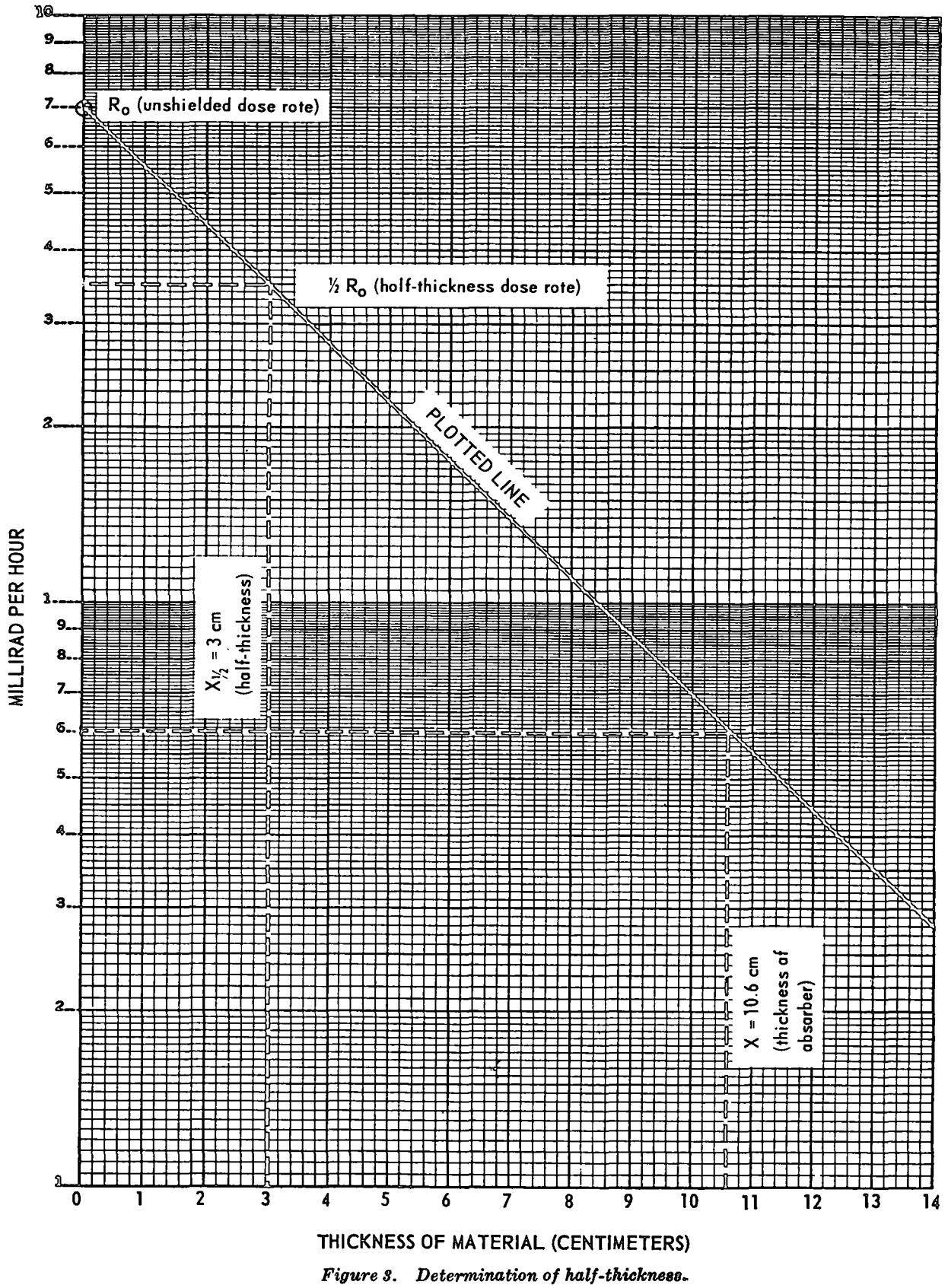

Figure 3. Determination of half-thickness.

2. Enter the table at 5 under the 2^n column and read the value of 2.4 under the n column.

3. $n=\frac{X}{X_{\frac{1}{2}}}$ $X=n\ (X_{\frac{1}{2}})=2.4\ (2)=\underline{4.8\text{ cm}}$

(*d*) Same as (1) (*d*) above.

1. $R=\frac{R_o}{2^n}$ $2^n=\frac{R_o}{R}=\frac{100}{25}=4$

2. Enter the table at 4 under the 2^n column and read the value of 2 under the n column.

3. $n=\frac{X}{X_{\frac{1}{2}}}$ $X_{\frac{1}{2}}=\frac{X}{n}=\frac{6}{2}=\underline{3\text{ cm}}$

6.18. Dose Buildup

a. Area Source. Data not available.

b. Point Source. To determine the amount of material required to shield against gamma radiation from a point source.

(1) Place between the source and the radiacmeter the amount of material listed in paragraph 6.20 to shield against beta radiation.

(2) Measure the strength of the source with a radiacmeter, keeping the material used to shield against beta radiation midway between the source and the measuring device.

(3) To compensate for dose buildup, due to the scattering of gamma photons within the shielding material, determine the transmission factor necessary to reduce the dose rate to the desired level.

(4) *Example:*

R_o (unshielded dose rate) = 450 mrad/hr
R (desired dose rate) = 2 mrad/hr
Energy of radiation = 0.8 MEV
Shielding material = Concrete

(*a*) Determine the transmission factor.

$$TF=\frac{R}{R_o}=\frac{2}{450}=.0044$$

(*b*) Enter the appropriate table in paragraph 6.19, depending on the energy of the radiation. Interpolate between tables if necessary.

(*c*) Amount of concrete material required for a transmission factor of .0044 (use .005):

Energy 0.5 MEV (Par. 6.19*a*) = 46 cm
Energy 1 MEV (Par. 6.19*b*) = 56 cm
Energy 0.8 MEV (Interpolate between 46 and 56 cm) = 52 cm

6.19. Centimeters of Material Required for Shielding to Include Compensation for Dose Buildup

a. Centimeters of Material (.5 MEV).

Transmission factor	Lucite	Water	Concrete	Aluminum	Iron	Lead
0.5	47	28	13	10	2.5	0.5
0.3	54.5	38	17.5	13.8	3.8	.88
0.1	70	57	26	21	6.0	1.6
0.08	-------	60	27.5	22.5	6.6	1.72
0.06	-------	65	29.5	24	7.3	1.9
0.04	-------	70	32.4	26.8	8.1	2.2
0.02	-------	80	37	30.5	9.5	2.6
0.009	-------	92	42	35	11	3.1
0.007	-------	94	43.8	36.5	11.5	3.28
0.005	-------	98	46	38	12.0	3.5
0.003	-------	105	49	41	13.2	3.8
0.001	-------	120	56	47	15.0	4.5
0.0008	-------	122	57	48	15.6	4.6
0.0006	-------	126	58.7	49.5	16.1	4.75
0.0004	-------	132	61	51.8	16.8	5
0.0002	-------	138	65	55	18	5.4
0.00009	-------	148	69.5	59	19.5	5.87
0.00007	-------	152	71	60.5	19.9	6
0.00005	-------	156	73	62	20.5	6.2
0.00003	-------	162	76	65	21.3	6.5
0.00001	-------	175	82	70	23.0	7.1

b. Centimeters of Material (1 MEV).

Transmission factor	Lucite	Water	Concrete	Aluminum	Iron	Lead
0.5	33	28	13	11	3.5	1.5
0.3	45	42	19.5	16	5.2	2
0.1	70	65	30	26	8.5	3.8
0.08	73	68	32	28	9.2	4
0.06	78	74	34.5	30	10	4.5
0.04	85	81	38	33	11	5
0.02	97	93	44	38.8	13	6
0.009	-------	107	51	44.5	15	7
0.007	-------	111	53	46.5	15.5	7.5
0.005	-------	117	56	49	16.5	8.0
0.003	-------	125	60	52.5	17.7	8.7
0.001	-------	144	69	60	20.5	10.3
0.0008	-------	148	70	62	21	10.5
0.0006	-------	153	72.5	64	21.7	11
0.0004	-------	160	75.5	67	22.7	11.5
0.0002	-------	172	80.5	71.5	24.4	12.4
0.00009	-------	185	86.5	77	26.3	13.4
0.00007	-------	188	88.5	78	27	13.7
0.00005	-------	195	91	81	28	14
0.00003	-------	203	95	84	29	15
0.00001	-------	220	104	91	32	16.5

c. Centimeters of Material (2 MEV).

Transmission factor	Lucite	Water	Concrete	Aluminum	Iron	Lead
0.5	33	32	15	13	4	2
0.3	47	49	23	18	6.5	3.3
0.1	75	80	37	32	11	6
0.08	82	84	40	35	11.9	6.5
0.06	88	90	43	38	13	7.2
0.04	97	101	48	42	14.5	8.2
0.02	115	118	57	50	17.2	9.7
0.009	132	138	65	58	20.2	11.5
0.007	139	143	68	61	21	12
0.005	147	150	72	65	22	12.8
0.003	160	163	78	70	24	14
0.001	------	190	90	80	28	16.2
0.0008	------	193	92	83	29	16.7
0.0006	------	200	95	86	29.8	17.3
0.0004	------	209	99	90	31	18.2
0.0002	------	224	107	97	33.5	19.5
0.00009	------	242	115	104	36.2	21.4
0.00007	------	247	118	107	37	21.8
0.00005	------	255	122	110	38	22.5
0.00003	------	265	127	115	40	23.7
0.00001	------	290	138	125	44	26

d. Centimeters of Material (3 MEV).

Transmission factor	Lucite	Water	Concrete	Aluminum	Iron	Lead
0.5	35	35	16	13	4.5	2
0.3	55	53	25	21	7	3.5
0.1	88	90	43	37	12.2	6.6
0.08	95	96	45	39	13.5	7.3
0.06	103	105	50	43	14.8	8
0.04	115	118	56	48	16.5	9
0.02	134	140	66	57	19.5	10.6
0.009	156	163	77	67	23	12.5
0.007	163	170	80	70	24	13.2
0.005	173	180	85	74	25.5	14
0.003	186	195	92	80	27.5	15.2
0.001	215	227	105	93	32	17.9
0.0008	222	233	108	95	32.8	18.5
0.0006	230	240	113	98	34	19.2
0.0004	240	252	117	103	35.5	20.1
0.0002	258	270	125	112	38.2	21.8
0.00009	280	293	136	121	41.5	23.7
0.00007	286	300	138	123	42.5	24.4
0.00005	295	308	143	128	44	25
0.00003	308	323	150	133	46	26.5
0.00001	335	352	165	145	50	29

6.20. Shielding (CM) for Beta

Element	Energy (MEV)					
	0.5	1	1.5	2	3	4
Lucite	0.2	0.4	0.6	0.8	1.3	1.7
Wood (soft)	.3	.7	1.2	1.6	2.5	3.3

6.21. Shipment of Point Sources

a. When any radioactive material is shipped or transported, it must be shielded and packaged in accordance with ICC regulations (par. 6.7).

b. An exception to *a* above would be in a theater of operations at which time military directives would govern.

c. To compute the shielding and size of container, assume that military directives dictate that the dose rate at the surface of the outside of the container will not exceed 200 millirad per hour.

(1) Determine the amount of shielding necessary, including dose buildup, to reduce the initial dose rate to 200 millirad per hour at a point away from the source that is equal to or greater than five times the largest linear dimension of the source.

(2) When actually shielding the source, place the shielding material next to the source.

(3) Package the shielded source in a shipping container that has a radius in all directions, from the center, equal to the distance determined in (1) above. The shielded source must be located at the center of the shipping container. Packing material is used to fill in around the shielded source.

6.22. 2^n values

n	2^n	n	2^n	n	2^n	n	2^n
0.0	1.000	5.0	32.0	10.0	1024	15.0	32768
0.1	1.072	5.1	34.2	10.1	1100	15.1	35100
0.2	1.149	5.2	36.7	10.2	1180	15.2	37600
0.3	1.232	5.3	39.2	10.3	1260	15.3	40200
0.4	1.320	5.4	42.1	10.4	1350	15.4	43200
0.5	1.415	5.5	45.2	10.5	1455	15.5	46400
0.6	1.515	5.6	48.4	10.6	1560	15.6	49600
0.7	1.627	5.7	52.0	10.7	1670	15.7	53300
0.8	1.743	5.8	56.0	10.8	1780	15.8	57400
0.9	1.868	5.9	60.0	10.9	1920	15.9	61600
1.0	2.000	6.0	64.0	11.0	2048	16.0	65536
1.1	2.150	6.1	68.0	11.1	2200	16.1	69700
1.2	2.300	6.2	74.0	11.2	2360	16.2	75800
1.3	2.470	6.3	78.0	11.3	2530	16.3	80000
1.4	2.570	6.4	84.0	11.4	2640	16.4	86200
1.5	2.830	6.5	90.0	11.5	2900	16.5	92300
1.6	3.030	6.6	97.0	11.6	3110	16.6	99500
1.7	3.250	6.7	104	11.7	3330	16.7	107000
1.8	3.480	6.8	112	11.8	3560	16.8	115000
1.9	3.730	6.9	119	11.9	3820	16.9	122000
2.0	4.000	7.0	128	12.0	4096	17.0	131072
2.1	4.280	7.1	136	12.1	4390	17.1	139000
2.2	4.590	7.2	146	12.2	4700	17.2	150000
2.3	4.950	7.3	157	12.3	5070	17.3	162000
2.4	5.280	7.4	170	12.4	5420	17.4	174000
2.5	5.650	7.5	181	12.5	5790	17.5	186000
2.6	6.050	7.6	194	12.6	6200	17.6	199000
2.7	6.500	7.7	206	12.7	6760	17.7	211000
2.8	6.950	7.8	220	12.8	7120	17.8	228000
2.9	7.450	7.9	240	12.9	7630	17.9	246000
3.0	8.000	8.0	256	13.0	8192	18.0	262000
3.1	8.55	8.1	272	13.1	8760	18.1	279000
3.2	9.18	8.2	292	13.2	9410	18.2	299000
3.3	9.85	8.3	312	13.3	10100	18.3	320000
3.4	10.60	8.4	338	13.4	10870	18.4	327000
3.5	11.30	8.5	360	13.5	11600	18.5	369000
3.6	12.10	8.6	385	13.6	12900	18.6	395000
3.7	13.00	8.7	415	13.7	13300	18.7	426000
3.8	13.90	8.8	445	13.8	14200	18.8	456000
3.9	15.00	8.9	480	13.9	15400	18.9	492000
4.0	16.00	9.0	512	14.0	16384	19.0	525000
4.1	17.20	9.1	550	14.1	17600	19.1	564000
4.2	18.40	9.2	580	14.2	18850	19.2	594000
4.3	18.70	9.3	630	14.3	20200	19.3	646000
4.4	21.20	9.4	680	14.4	21800	19.4	696000
4.5	22.60	9.5	720	14.5	23200	19.5	738000
4.6	24.20	9.6	770	14.6	24800	19.6	788000
4.7	25.90	9.7	830	14.7	26600	19.7	852000
4.8	27.80	9.8	890	14.8	28500	19.8	903000
4.9	29.80	9.9	950	14.9	30600	19.9	974000
						20.0	1050000

6.23. Shielding Evaluation and Shelter Requirements

a. For a generalized table refer to paragraph 6.15.

b. To determine the transmission factor for a particular structure, compute in accordance with appendix E, TM 3–225.

6.24. Radiological Recovery of Fixed Military Installations

Refer to TM 3–225 for the necessary information to delineate the problems that must be faced when fixed installations become contaminated by radiological operations; to provide planning techniques that form an adequate basis for decisions regarding pre-attack preparation or post-attack recovery; and for a summary of the methods and operating procedures to be followed in accomplishing both protection and recovery.

CHAPTER 7

BIOLOGICAL DEFENSE

7.1. References

For additional information on biological defense, see TM 3–216, FM 21–40, FM 21–41, FM 3–5, and TM 3–220.

7.2. Typical Diseases Injurious to Man and Animals

Disease	Causative organism	Type of organism	Host	Incubation period	Symptoms	Duration of effects	Mortality (untreated)	Treatment	Remarks
Anthrax	*Bacillus anthracis.*	Bacteria	Animals and humans.	1–7 days; usually less than 4 days.	3 forms in man—cutaneous, pulmonary (wool sorter's disease), and intestinal. Cutaneous, or skin, form occurs most frequently upon hands and forearms. Pulmonary form is an infection of the lungs characterized by weakness, fever, pneumonia, shock, delirium, death. Intestinal cases are rare.	25 days with cutaneous; 40 days to indefinite with pulmonary.	2–25%—cutaneous; 90–100%—pulmonary; 100% (usually)—intestinal.	Penicillin, tetracyclines for skin cases. Similar treatment for pulmonary and intestinal cases may be useful in early stages.	Spore former.
Brucellosis (undulant fever).	Brucella species (abortus, melitensis, suis).	Bacteria	Cattle, sheep, goats, hogs, and humans.	Variable; 2 weeks to one month or more.	Extremely varied. Intermittent fever, sweating, chills, joint and muscle pains, fatigue, weakness, insomnia, and depression.	Can last for months, sometimes years (chronic). Estimate is 3 months average.	Without therapy—2%.	Prompt treatment with antibiotics, dehydrostreptomycin, and tetracyclines reduces fever and acute symptoms.	Relapse rate high.
Cholera (Asiatic Cholera).	*Vibrio comma.*	Bacteria	Humans	1–5 days; usually	Acute infectious gastrointestinal disease of man. Sudden onset	Variable	15–90% (5%, treated).	No specific chemotherapy. Replenish fluid loss.	May have 20–30 stools per day. Excessive loss

7.2. Typical Diseases Injurious to Man and Animals—Continued

Disease	Causative organism	Type of organism	Host	Incubation period	Symptoms	Duration of effects	Mortality (untreated)	Treatment	Remarks
				3 days (can be short, 6–8 hours; explosive onset).	with nausea, vomiting, watery diarrhea, rapid loss of body fluids, toxemia, and collapse.			Antibiotics not too effective. Chloromycetin, aureomycin, and terramycin cause rapid disappearance of the vibrio. Vaccine available.	of fluids.
Plague (Black Death).	*Pasteurella pestis.*	Bacteria	Humans	2–19days — bubonic plague; 2–4 pneumonic plague.	Bubonic — transmitted to man by bite of flea from infected rat. Bacilli spread rapidly through lymphatic system, causing enlarged lymph nodes (buboes) in the groin. Bacilli may escape from the nodes, invade the blood stream, and produce a generalized infection. Pneumonic—inhalation of organism. Headache, fever, nausea, vomiting, muscle and bone pains. Rapid spread resulting in hemorrhagic pneumonia.	7–10 days—bubonic form; more than 30 days—pneumonic form.	25–50%—bubonic form; 90–100%—pneumonic form.	Streptomycin and tetracyclines effective if given early. Vaccine available.	Vector transmission; airborne transmission. Pneumonic form highly contagious.
Glanders (farcy).	*Actinobacillus mallei.*	Bacteria	Horses, mules, asses, dogs, and goats.	2–5 days	Characterized by nodules appearing in skin, lymph nodes, lymph channels, respiratory tract, and intestinal tract. Nodules in lymph channels may break down, forming discharging ulcers. May be acute or chronic in horses. Infection of	Uncertain; some recoveries do occur.	100%—acute; 50–70%—chronic.	Sulfonamides, streptomycin chloromycetin, aureomycin. No vaccine available.	Man is infected occasionally.

					skin is known as farcy and generalized infection is known as glanders.				
Psittacosis (parrot fever, ornithosis).	Psittacosis	Virus	Humans and birds.	6–14 days; occasionally 3 or 4 weeks.	Onset may be sudden or gradual. Influenzalike, headache, sore throat, nonproductive cough, chills, physical signs of pneumonia, backache, constipation, weakness, prostration, and sometimes delirium.	6–60 days	10% or less. More deaths in 40–60 age groups.	Broad spectrum antibiotics, such as chlortetracycline or oxytetracycline.	Disease moderately high contagiousness. Moderately high airborne transmission.
Smallpox (variola).	Variola virus.	Virus	Humans	6–22 days	Severe fever, blisters of the skin, backache, prostration.	3–6 weeks for survivors.	8% to more than 30%.	No specific therapy. Vaccine available.	Highly contagious. Airborne transmission very high.
Dengue fever.	Dengue fever virus.	Virus	Humans and monkeys.	4–10 days	Sudden onset, fever, chills, headache, backache, joint and muscle pains, weakness, prostration, enlargement of lymph nodes, and sometimes a skin rash.	1–3 weeks	Less than 1%.	No specific therapy. Supportive treatment. Vaccine available.	Very incapacitating.
Epidemic typhus.	*Rickettsia prowazeki.*	Rickettsia	Humans	10–12 days.	Acute infectious disease characterized by severe headache, sustained high fever, general pains, and a skin rash. Transmission is by the body louse. Not communicable directly from man to man.	Variable	10–40%	Antibiotics. Supportive therapy. Vaccine available.	One attack confers immunity, but this immunity is not always permanent.
Rinderpest (cattle plague).	Rinderpest virus.	Virus	Cattle, oxen, water buffaloes, sheep, goats, camels, and swine.	3–9 days	Highly contagious and fatal disease. Sudden onset, high fever, inflammation of the digestive tract, erosion of the mucous membranes of the mouth, bloody diarrhea, emaciation, and death.	4–8 days	15–95%	Antiserum, antibiotics, supportive therapy.	Recovered animals usually immune to second attacks. Highly contagious from animal to animal.
Histoplasmosis.	*Histoplasma capsulatum.*	Fungus	Humans and animals.	5–18 days.	Chronic, local, or systemic infectious disease. Tuberculosis-like lesions of the lungs,	Variable	Progressive form usually fatal.	No immunization. Amphotericin appears to be of some value.	Noncontagious disease.

7.2. Typical Diseases Injurious to Man and Animals—Continued

Disease	Causative organism	Type of organism	Host	Incubation period	Symptoms	Duration of effects	Mortality (untreated)	Treatment	Remarks
					involvement of internal organs (spleen and liver). Transmission is usually by inhalation of spores.		More than 1% develop progressive disease.		
Botulism	*Clostridium botulinum.*	Bacteria (toxin).	Humans and animals.	1–3 days	The toxin of this organism attacks the central nervous system. Vomiting, double vision, difficult breathing, and respiratory paralysis leading to death.	1–3 days	60–90%	Antisera of doubtful therapeutic value. Polyvalent toxoid available.	Disease is not contagious. Poisoning due to toxin of the bacteria.

7.3. Typical Diseases and Plant Growth Regulators Injurious to Plants

Disease	Causative organism	Type	Disseminated by—	Effects	Prevention and control
Stem rust of cereals.	Fungus (*Puccinia graminis*).	Fungal spore.	Normal wind currents.	Spores fall on susceptible host plants and spores germinate and produce orange-red pustules on leaves and stems of plants. This leads to excessive water loss by the plant, causing reduction in yield. As each pustule develops, it produces spores capable of causing new infections in susceptible plants.	Use of resistant varieties offers the only practical control. Fungicidal dusts are helpful but high in cost.
Curly top virus of sugar beets.	Virus (*Chlorogenous eutetticola*).	Virus	Natural infection by the beet leafhopper.	Symptoms include a distorted thickening with unrolled edges of younger foliage and yellowing of older leaves. Leaves have a dull green color, eventually fading and dying. Infects other plants such as tomatoes and beans.	Planting of resistant varieties and control of insect vector.
Late blight of potato.	Fungus (*Phytophthora infestans*).	Fungal spore.	Air for short distances, normally by infected seed stock.	Large water-soaked lesions appear on foliage. The underside of these lesions is covered with fine, white mold-like spores. Destruction of foliage reduces yield and the spores cause tuber rot which may destroy the remainder of the crop.	Sanitation and use of resistant varieties. Chemical control measures are satisfactory but require time, machinery, and money since spraying must be done at 7- to 10-day intervals.
Rice blast	Fungus (*Piricularia oryzae*).	Fungal spore.	Natural wind currents.	Lesions are produced at the base of the leaf sheaths and in the neck region of the stem, causing the stem to break over. Losses result from breaking of the stem, and loss of moisture through the lesions produced damage to the developing grain.	Use of resistant varieties, rotation of cropping land, and fungicidal dusts may be of some value.
None	None	Chemical plant growth regulator.	Aerosol spray	Chemical plant growth regulators such as 2,4–D and 2,4,5–T may be used to kill or reduce yields of certain crops. The stems and leaves may twist and bend or completely die. The stems may swell, develop cracks, and form callous tissue. This abnormal growth results in no yield, reduced and ineffective yield, or an unusable yield.	After contact with the susceptible plant, no measures are effective.

7.4. Field Sanitation

The individual should take the following field sanitation measures for his own protection against biological agents:

a. Report all illnesses to medical personnel.

b. As soon as possible after exposure to a biological aerosol, remove clothing and take a shower, using plenty of soap and scrubbing thoroughly; treat all cuts and abrasions, using ordinary first-aid measures.

c. If decontamination of exposed clothing is not possible by laundries or impregnating plants, decontaminate cotton clothing by boiling it in soapy water for 15 minutes and then let it dry in the sun; decontaminate woolen clothing with a vapor decontaminant (par. 5.4*c*).

d. To decontaminate water, boil for at least 15 minutes.

e. Thorough cooking at high temperature will decontaminate food. To decontaminate food containers, immerse in a 2-percent bleach solution. Avoid eating while attack is in progress.

f. To decontaminate leather and rubber equipment, wash and scrub items in hot soapy water for at least 20 minutes.

7.5. Field Training

The standard simulant agents *Serratia marcescens* and *Bacillus globigii* are suitable for use in defense training because they are not disease-producing and because, when grown on nutrient media, they produce colonies of characteristic colors which are aids to the quick identification of these two bacteria. These simulated agents are not intended for indiscriminate use upon personnel.

APPENDIX I

REFERENCES

AR 11–8	Logistics Policies.
AR 40–580	Control of Hazards to Health from Radioactive Materials.
AR 40–582	Evaluating and Reporting Internal Exposure to Radioactive Materials.
AR 220–50	Regiments; General Provisions.
AR 220–58	Organization and Training for Chemical, Biological, and Radiological Operations.
AR 320–5	Dictionary of United States Army Terms.
AR 320–50	Authorized Abbreviations and Brevity Codes.
AR 600–20	Army Command Policy and Procedures.
AR 700–62	Chemical Protective Clothing Policy and Utilization of Certain Chemical Corps Units and Equipment in Combat Areas.
AR 710–60	Replacement Factors and Consumption Rates for Army Materiel.
AR 711–16	Installation Stock Control and Supply Procedures.
AR 725–50	Requisitioning, Receipt, and Issue System.
AR 735–35	Supply Procedures for TOE Units, Organizations, and Non-TOE Activities.
AR 743–41	Shed and Open Storage of Supplies.
AR 755–380	Disposal of Radioactive Material.
FM 3–5	Chemical, Biological, and Radiological (CBR) Operations.
FM 3–10	Chemical and Biological Weapons Employment.
FM 3–12	Operational Aspects of Radiological Defense (when published).
FM 3–50	Chemical Smoke Generator Battalion and Chemical Smoke Generator Company.
FM 3–85	Chemical Service Units.
FM 5–34	Engineer Field Data.
FM 5–35	Engineers' Reference and Logistical Data.
FM 9–2	Ordnance Corps Logistical Data.
FM 10–13	Quartermaster Reference Data.
FM 20–32	Land Mine Warfare.
FM 20–33	Ground Flame Warfare.
FM 21–5	Military Training.
FM 21–6	Techniques of Military Instruction.
FM 21–30	Military Symbols.
FM 21–40	Small Unit Procedures in Nuclear, Biological, and Chemical Warfare.
FM 21–41	Soldier's Handbook for Nuclear, Biological, and Chemical Warfare.
FM 21–48	Chemical, Biological, and Nuclear Training Exercises and Integrated Training.
FM 38–1	Logistics Supply Management.
FM 38–5	Logistics Maintenance Management.
FM 55–15	Transportation Corps Reference Data.
FM 100–5	Field Service Regulations; Operations.
FM 100–10	Field Service Regulations; Administration.

FM 101–1	Staff Officers' Field Manual; The G1 Manual.
FM 101–5	Staff Officers' Field Manual; Staff Organization and Procedure.
FM 101–10, Part I	Staff Officers' Field Manual; Organization, Technical, and Logistical Data; Unclassified Data.
FM 101–10, Part II	Staff Officers' Field Manual; Organization, Technical, and Logistical Data; Extracts of Tables of Organization and Equipment.
(S) FM 101–10, Part III	Staff Officers' Field Manual; Organization, Technical, and Logistical Data; Classified Data (U).
TM 3–205	Protective Masks and Accessories.
TM 3–210	Fallout Prediction.
TM 3–215	Military Chemistry and Chemical Agents.
TM 3–216	Military Biology and Biological Warfare Agents.
TM 3–220	Chemical, Biological, and Radiological (CBR) Decontamination.
TM 3–240	Field Behavior of Chemical Agents.
TM 3–250	Storage, Shipment, and Handling of Chemical Agents and Hazardous Chemicals.
TM 3–255	Chemical Filling and Handling Equipment.
TM 3–281	Impregnating Plant, Clothing, M2.
TM 3–300	Ground Chemical Munitions.
TM 3–304	Protective Clothing and Accessories.
TM 3–350	Improvised CBR Protective Shelters.
TM 3–366	Flamethrower and Fire Bomb Fuels.
TM 3–400	Chemical Bombs and Clusters.
TM 3–409	Impregnating Plant, Clothing, M2A1.
TM 3–500	Chemical Corps Equipment Data Sheets.
TM 9–500	Ordnance Corps Equipment Data Sheets.
TM 9–1300–203	Ammunition for Antiaircraft, Tank, Antitank, and Field Artillery Weapons.
TM 9–1300–204	Ammunition for Recoilless Rifles.
TM 9–1300–205	Ammunition for Mortars.
TM 9–1900	Ammunition, General.
TM 9–1901–1	Ammunition for Aircraft Guns.
TM 9–1950	Rockets.
TM 9–2800	Military Vehicles.
TM 10–1619	Quartermaster Materials Handling Equipment.
(CM) TM 11–487I	Directory of Signal Corps Equipment: Sound and Light and Miscellaneous Equipment (U).
TM 11–487J	Directory of US Army Signal Equipment: Radiac Equipment.
TM 38–230	Preservation, Packaging, and Packing of Military Supplies and Equipment.
TM 38–250	Packaging and Handling of Dangerous Materials for Transportation by Military Aircraft.
TM 57–210	Air Movement of Troops and Equipment.
TM 743–200	Storage and Materials Handling.
TM 743–200–1	Storage and Materials Handling.
TC 3–12	Nuclear Accident Contamination Control.
SB 3–24	Shipping Chart for Chemical Corps Ammunition, Ammunition Components, and Military Chemical Agents.
SB 3–32	Disposal of Supplies and Equipment, Chemical Corps Ammunition.
SB 3–33	Chemical Corps Adopted Items of Materiel.
SB 3–34	Maintenance Float, Chemical Corps Equipment.
SB 3–39	Basic Loads of Chemical Nontoxic Ammunition.

SB 11–206	Film Badge (Photodosimetry) Supply and Service for Technical Radiation Exposure Control.
SB 11–477	Safe Handling, Storage, and Transportation of Calibrator, Radiac, TS–784/PD.
SB 38–8–1	Storage of Army Supplies and Equipment in Shed and Open Storage.
(C) SB 38–26	Ammunition Day of Supply (U).
SB 38–100	Preservation, Packaging, and Packing Materials, Supplies, and Equipment Used by the Army.
SB 710–1	Supply Control: Replacement Factors for Army Materiel, PEMA.
SB 725–350	Chemical Corps Regulated Items.
DA Pam 108–1	Index of Army Motion Pictures, Film Strips, Slides, and Phono-Recordings.
DA Pam 310–1	Index of Administrative Publications.
DA Pam 310–3	Index of Training Publications.
DA Pam 310–4	Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.
DA Pam 310–5	Index of Graphic Training Aids and Devices.
DA Pam 310–7	Index of Tables of Organization and Equipment, Type Tables of Distribution, and Tables of Allowances.
DA Pam 310–23	Index of Supply Manuals: Chemical Corps.

Handbook of Federal Regulations Applying to Transportation of Radioactive Materials, May 1958 (for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.).

APPENDIX II

CHEMICAL FIRE PLAN APPENDIX TO FIRE SUPPORT PLAN ANNEX

1. Purpose and Scope

The purpose of this appendix is to illustrate a typical chemical fire plan for a division. The examples set forth those aspects of chemical fire planning that are of particular concern to the division chemical officer.

2. Format

The chemical fire support plan will appear as an appendix to the unit fire support plan. The fire support plan is an annex to the operations order and is the basic document for planning, coordinating, and integrating all available fire support for support of ground operations. Guidance on the general concept for employment of chemical fires will normally be stated in paragraph 3*a*, CONCEPT OF THE OPERATION. In addition to this general guidance, an entire subparagraph of paragraph 3, fire support plan, is devoted to chemical fires. This paragraph will contain detailed information relative to employment of chemical fires and will be supported by the chemical fire support plan, an appendix to the fire support plan. The format for the chemical fire support plan is the same as that for the artillery fire plan: a graphic overlay showing target concentration, target lists, and schedule of fires. The chemical fire plan should be as brief and concise as possible. There will be occasions in which the preparation of a chemical fire plan will not be necessary. This is particularly true when there are only a few chemical targets considered for attack. In such cases all details of chemical fire support coordination will be stated in the chemical subparagraph of the fire support plan, with the targets graphically portrayed on the artillery fire plan. The chemical subparagraph of the fire support plan must, however, direct attention to the artillery fire plan.

3. Composition

a. The chemical fire support plan will consist of a heading, references, acknowledgment, and signature (fig. 4). Written material will be kept to a minimum. Information normally outlined in the fire support plan will not be repeated in the chemical fire support plan. Minimum essential items appearing in the chemical fire plan will be—

(1) The graphical portrayal of targets (fig. 4). Targets are shown as tick marks, the center of the tick being the center of the target. Concentrations are numbered in the upper right-hand corner of the tick.

(2) A target list (fig. 4). The target list contains those concentrations that are planned. (The chemical officer will provide all the data in the target list, with the exception of the firing units.)

(3) A schedule of fire (fig. 4). The schedule of fires shows the concentrations to be fired (above the horizontal bar), the time to commence firing and the time firing must be completed (horizontal bar), and the amount of ammunition to be expended per unit (below the horizontal bar).

b. Additional information which may appear on the chemical fire plan:

(1) A table of groups of fires. The table of groups of fires lists the fires planned to cover a single tactical locality too large to be covered by a single concentration.

(2) Marginal information (overlay). Information placed on the margin of the overlay which is considered pertinent and necessary.

Figure 4. Example, chemical fire support plan.
(Located in back of manual)

APPENDIX III

CBR ANNEX TO A DIVISION SOP (EXAMPLE)

(Classification)

20th Inf Div
STUPPACH (NV 5477), GERMANY
1 November 196__

ANNEX H (CBR) TO 20TH INFANTRY DIVISION SOP

1. GENERAL.
   a. Purpose. This annex prescribes procedures to be taken by this command to reduce casualties, damage, and interruption of operations in the event of chemical, biological, or radiological operations.
   b. Unit SOP's. Subordinate command units issue SOP's to conform.
2. REFERENCES.
   a. Annex D (CBR) to IV Corps SOP.
   b. Annex C to USCONARC Training Directive, Chemical, Biological, Radiological, and Nuclear Defense Training, 3 May 1962.
   c. AR 220–58, Organization and Training for Chemical, Biological, and Radiological Operations.
   d. FM 3–12, Operational Aspects of Radiological Defense (when published).
   e. FM 21–40, Small Unit Procedures in Nuclear, Biological, and Chemical Warfare.
   f. FM 21–41, Soldier's Handbook for Nuclear, Biological, and Chemical Warfare.
   g. FM 21–48, Chemical, Biological, and Nuclear Training Exercises and Integrated Training.
   h. TM 3–210, Fallout Prediction.
   i. TM 3–220, Chemical, Biological, and Radiological (CBR) Decontamination.
   j. Army Subject Schedule 21–6, Individual Protective Measures Against Chemical, Biological, and Nuclear Attacks.
3. ORGANIZATION.
   a. The normal command and staff functions will be used in the conduct of CBR defensive measures and operations. Each activity will absorb those phases of CBR operations which fall within its scope of operation. The responsibility for the status of CBR training remains with the unit commander (AR 220–58).
   b. The division chemical officer will direct the operations of the chemical, biological, and radiological element (CBRE) of the division TOC, which will perform the primary functions of coordinating chemical and biological operations with other tactical support operations, predicting fallout resulting from the employment of nuclear weapons by friendly and enemy forces, and evaluating CBR contamination data.

(Classification)

(Classification)

c. Chemical detection teams, radiological survey parties, and decontamination teams will be organized, equipped, and trained by each headquarters listed below:

* * * * * * *

These teams and parties will be organized and equipped as shown in appendix 1. SOP's will indicate location of all equipment listed in this annex.

4. RESPONSIBILITIES.

Responsibilities are as outlined in current pertinent DA publications, particularly FM 21–40, FM 21–41, FM 100–1, FM 101–5, and TC 101–2.

a. Individuals will:

* * * * * * *

b. Commanders will:

* * * * * * *

c. Staff Responsibility.

(1) G1 Area.

* * * * * * *

(2) G2 Area.

* * * * * * *

(3) G3 Area.

* * * * * * *

(4) G4 Area.

* * * * * * *

(5) Division Civil Affairs Officer (G3).

* * * * * * *

(6) Division Chemical Officer.

* * * * * * *

(7) Division Engineer Officer.

* * * * * * *

(8) Division Signal Officer.

* * * * * * *

(9) Division Provost Marshal.

* * * * * * *

(10) Division Aviation Officer.

* * * * * * *

d. CBRE. The CBRE (chemical, biological, and radiological element) of the division Tactical Operations Center has the general mission of predicting fallout from nuclear weapons, coordinating radiological survey, and collecting and evaluating radiological monitoring and survey data. The CBRE is the focal point for radiological information in the division.

e. Support Command.

* * * * * * *

f. Division Artillery and FSE.

(1) After an enemy or friendly nuclear explosion, advises CBRE as to ground zero, height of burst, cloud height, and cloud diameter.

* * * * * * *

g. Division Aviation.

(Classification)

(Classification)

* * * * * * *

5. ALARMS AND ALERTS.

a. Imminent Attack.

* * * * * * *

b. Actual Attack.

* * * * * * *

c. All Clear.

* * * * * * *

d. Friendly Nuclear Bursts.

* * * * * * *

6. PROCEDURES. (If consistent with requirements for continuing the mission.)

a. Imminent Attack.

* * * * * * *

b. Actual Attack.

* * * * * * *

c. All Clear.

(1) Continue the mission.

(2) Surveys:

* * * * * * *

(3) In the event of enemy nuclear detonation.

* * * * * * *

d. Friendly Nuclear Bursts.

* * * * * * *

e. Decontamination.

* * * * * * *

7. PROTECTION.

a. Individual.

* * * * * * *

b. Unit.

* * * * * * *

8. INTELLIGENCE.

a. General. All units and agencies will be constantly alert for information relative to enemy capabilities in CBR operations, such as: State of enemy CBR training and discipline.

* * * * * * *

b. Required Information. The following information will be reported at once through intelligence channels:

(1) Appearance of unusual aircraft, weapons, or equipment (very heavy artillery pieces) or of smokes or mists sprayed from aircraft, and so forth.

* * * * * * *

9. RADIATION EXPOSURE.

a. The amount of radiation (dosage) to which personnel of a unit can justifiably be exposed must be determined at the battalion level or by higher commander, based on previous unit exposure history and the current situation.

* * * * * * *

b. Record of exposure.

(Classification)

(Classification)

* * * * * * *

10. SUPPLY. Units will have all CBR equipment authorized by TOE and TA.

* * * * * * *

11. AREA STORAGE AND HANDLING OF TOXIC CHEMICAL-FILLED MUNITIONS.

* * * * * * *

12. TRAINING.

* * * * * * *

13. REPORTS.

a. Flash reports of enemy nuclear attack to next higher and lower headquarters and adjacent units. (See appendix 2.)

* * * * * * *

b. Flash reports of enemy chemical or biological attack to next higher and lower headquarters and adjacent units. (See appendix 4.)

c. Commander in each unit reports estimated casualties, damage, and unit effectiveness to next higher headquarters immediately after the CBR attack. Classify the report "CONFIDENTIAL."

d. Submit DA Form 890, "Report of Enemy Use of CBR Agents," to next higher headquarters after each enemy attack, precedence deferred. Classify the report "CONFIDENTIAL." Copies will be forwarded without delay to G2 and CBRE.

e. CBR survey party reports will be submitted to the next higher headquarters, giving the location, type, and intensity of the contamination and the time noted (appendix 3). Forwarded without delay to the division CBRE.

Acknowledge.

GRAHAM
Maj Gen

Appendixes: 1—CBR Reconnaissance Plan (Omitted)
2—Nuclear Explosion Flash Message (Omitted)
3—Residual Radiation Report (Omitted)
4—Chemical or Biological Flash Message (Omitted)

Distribution: C, F plus 100 to G3

OFFICIAL:
/s/ Booth
BOOTH
G3

(Classification)

APPENDIX IV

CBR TRAINING DIRECTIVE (EXAMPLE)

(Classification)

Headquarters_____Division

Location_____

Date_____

Effective until _____ unless sooner rescinded.

1. GENERAL. A chemical, biological, and radiological training program is hereby set up to:
   a. Insure that the individual soldier has sufficient knowledge of the characteristics and potentialities of CBR agents and protective equipment to exploit to maximum advantage the use of these agents by friendly forces.
   b. Develop in the individual soldier a proficiency in protective measures which will enable him to survive CBR attack with minimum reduction in combat effectiveness.
   c. Develop and maintain in this organization the capability of successfully accomplishing its mission while under CBR attack with a minimum loss of personnel, time, and equipment.
2. PROGRAM OF INSTRUCTION.
   a. The attached program of 6 hours of CBR training (Incl 1) constitutes the minimum training required for attainment of individual proficiency in CBR operations.
   b. Each individual must attend every hour of the program to be credited with completion of the program.
   c. All military personnel, both officer and enlisted, will participate in a gas chamber exercise at least once each year.
3. INTEGRATION OF CBR TRAINING.
   a. Continuous emphasis will be placed on CBR training by refresher instruction and by incorporation of realistic, combatlike CBR situations into unit exercises. Such situations should call for action not only by the individual but also by commanders and their staffs. Interspersion of isolated situations between normal periods of other training is not acceptable as integration.
   b. In addition to formal instruction, the principles and methods of CBR defense will be brought to the attention of the individual soldier by the integration of CBR instruction into daily unit training. For example, classes on first aid will include first aid for toxic chemical casualties and personal hygiene as a defense against biological operations. Lesson plans will specify how the integration of CBR training is to be accomplished.
   c. Specially trained unit personnel will assist the commanding officer in planning the integration of CBR training when called upon to do so.

(Classification)

(Classification)

4. MINIMUM STANDARDS.
   a. The knowledge and skills required for most satisfactory reaction to an enemy's use of CBR agents must rest primarily with the individual soldier, commander, and operational staff; they must be able to meet minimum standards of proficiency in this regard, as outlined in FM 21–40.
   b. CBR training will emphasize ability to solve practical situations, rather than attainment of theoretical knowledge.

5. PUBLICATIONS.
   a. All company, battery, and detachment commanders will insure that the following publications are available within their units:

FM 3–5	Chemical, Biological, and Radiological (CBR) Operations.
FM 3–12	Operational Aspects of Radiological Defense (when published).
FM 21–11	First Aid for Soldiers.
FM 21–40	Small Unit Procedures in Nuclear, Biological, and Chemical Warfare.
FM 21–41	Soldier's Handbook for Nuclear, Biological, and Chemical Warfare.
FM 21–48	Chemical, Biological, and Nuclear Training Exercises and Integrated Training.
TM 3–205	Protective Masks and Accessories.
TM 3–210	Fallout Prediction.
TM 3–220	Chemical, Biological, and Radiological (CBR) Decontamination.
TM 3–225	Radiological Recovery of Fixed Military Installations.
TM 3–300	Ground Chemical Munitions.
TM 3–304	Protective Clothing and Accessories.
TM 3–306	Detector Kits, Chemical Agent, M18, M9A2, and M15.
TM 3–350	Improvised CBR Protective Shelters.
TM 3–4240–202–15	Mask, Protective, Field, M17.
TC 3–10	Defense Against V-Agents.

   b. In addition to these general references, copies of Annex C to USCONARC Training Directive, Chemical, Biological, Radiological, and Nuclear Defense Training, 3 May 1962, will be available for guidance of CBR personnel in planning the CBR training for the division.
   (Authority line)

(Signature block)

1 Incl
CBR Defense Training
Program (Omitted)

OFFICIAL:

(Classification)

APPENDIX V

CONVERSION TABLES

1. Mass-Energy Conversion Factors

Multiply—	By—	To obtain—	Multiply—	By—	To obtain—
Mass units (mu)	9.31×10^{2}	Mev.	Calories (cal)	2.81×10^{19}	Mass units.
	1.49×10^{-3}	Ergs.		2.62×10^{13}	Mev.
	3.56×10^{-11}	Calories.		4.18×10^{7}	Ergs.
	4.15×10^{-17}	Kilowatt-hours.		1.16×10^{-6}	Kilowatt-hours.
Mev	1.07×10^{-3}	Mass units.	Kilowatt-hours (kw-hr)	2.41×10^{16}	Mass units.
	1.60×10^{-6}	Ergs.		2.25×10^{19}	Mev.
	3.83×10^{-14}	Calories.		3.60×10^{13}	Ergs.
	4.45×10^{-20}	Kilowatt-hours.		8.60×10^{5}	Calories.
Ergs	6.71×10^{2}	Mass units.	Gram (gm)	6.03×10^{23}	Mass units.
	6.24×10^{5}	Mev.			
	2.39×10^{-8}	Calories.			
	2.78×10^{-14}	Kilowatt-hours.			

2. Linear Measure Conversion Factors

	Nautical miles	Statute miles	Kilometers	Cable lengths	Rods	Fathoms	Meters	Yards	Feet	Inches	Centimeters	Millimeters
1 nautical mile	1	1.1516	1.853	8.446	368.5	1,014	1,853	2,027	6,080.2	72,960		
1 statute mile	.8684	1	1.6093	7.33	320	880	1,609.3	1,760	5,280	63,360		
1 kilometer	.5396	.6214	1	4.56	198.85	546.7	1,000	1,094	3,280.8	39,372		
1 cable length				1	43.636	120	219.5	240	720	8,640		
1 rod				.0229	1	2.75	5.0292	5.5	16.5	198		
1 fathom				.0084	.3636	1	1.829	2	6	72	182.9	1,829
1 meter				.0046	.1988	.5467	1	1.094	3.281	39.37	100	1,000
1 yard				.0042	.1818	.5	.9144	1	3	36	91.44	914.4
1 foot				.0014	.0606	.167	.3048	.3333	1	12	30.48	304.8
1 inch							.0254	.0277	.0833	1	2.54	25.4
1 centimeter									.0328	.3937	1	10
1 millimeter										.0394	.1	1

3. Surface Measure Conversion Factors

	Square miles	Square kilometers	Hectares	Acres	Ares	Square rods	Square meters [1]	Square yards	Square feet	Square inches	Square centimeters
1 square mile	1	2.59	259	640	25,900	102,400	2,589,998	3,097,600			
1 square kilometer	.3861	1	100	247	10,000	39,537	1,000,000	1,195,985			
1 hectare	.00386	.01	1	2.471	100	395.4	10,000	11,960			
1 acre	.00156	.00405	.4047	1	40.47	160	4,046.87	4,840	43,560		
1 are			.01	.0247	1	3.9537	100	119.6	1,076.4		
1 square rod			.00253	.00625	.253	1	25.29	30.25	272.25		
1 square meter[1]			.0001	.00025	.01	.0395	1	1.196	10.764	1.550	
1 square yard				.00021	.0084	.0331	.8361	1	9	1,296	
1 square foot							.0929	.1111	1	144	929
1 square inch									.0069	1	6.4514
1 square centimeter										.155	1

[1] Also expressed as centiare.

4. Volumetric Measure Conversion Factors

	Cubic inches	Cubic feet	Cubic yards	Cubic centimeters	Cubic decimeters	Cubic meters	Measurement tons [1]	Register tons
1 cubic inch	1	0.00058		16.387	0.0164			
1 cubic foot	1,728	1	0.037		28.317	0.283		
1 cubic yard		27	1		764.56	.7646		
1 cubic centimeter	61.025			1	.001			
1 cubic decimeter		.0353		1,000	1	.001		
1 cubic meter		35.314	1.3079		1,000	1		
1 measurement ton [1]		40	1.48			1.133	1	0.4
1 register ton		100	3.704			2.83	2.5	1

[1] Also expressed as ship ton.

5. Liquid Measure Conversion Factors

	Cubic centimeters	Cubic inches	Liters	United States			British		
				Pints	Quarts	Gallons	Pints	Quarts	Gallons
1 cubic centimeter	1	0.061	0.001						
1 cubic inch	16.387	1	.0164	0.0346	0.0173	0.0043	0.0288	0.0144	0.0036
1 liter	1,000	61.025	1	2.1134	1.0567	.2642	1.76	.88	.22
1 U.S. pint	473.17	28.875	.473	1	.5	.125	.8327	.4164	.1042
1 U.S. quart	946.33	57.75	.9643	2	1	.25	1.665	.8327	.208
1 U.S. gallon	3,785.33	231	3.785	8	4	1	6.66	3.33	.8327
1 British pint	568.75	34.668	.5688	1.201	.6	.15	1	.5	.125
1 British quart	1,136.2	69.335	1.1365	2.402	1.201	.3	2	1	.25
1 British gallon	4,544.8	277.34	4.546	9.616	4.808	1.201	8	4	1

6. Dry Measure Conversion Factors

	Cubic centimeters	Cubic inches	Liters	United States				British			
				Pints	Quarts	Pecks	Bushels	Pints	Quarts	Pecks	Bushels
1 cubic centimeter	1	0.061	0.001								
1 cubic inch	16.387	1	.0164	0.0297	0.0148	0.0019	0.00047	0.0288			
1 liter	1,000	61.025	1	1.8162	.908	.1135	.0284	1.759	0.8795	0.1099	0.0275
1 U.S. pint	550.6	33.6	.55	1	.5	.0625	.156	.969	.4845	.0605	.015
1 U.S. quart		67.2	1.101	2	1	.125	.0313	1.938	.969	.121	.03
1 U.S. peck		537.6	8.810	16	8	1	.25	15.5	7.752	9.69	.2422
1 U.S. bushel		2,150.42	35.238	64	32	4	1	62.016	31.01	3.876	.969
1 British pint	568.3	34.68	.5679	1.03205	.516	.0645	.0164	1	.5	.0625	.0156
1 British quart		69.35	1.1359	2.064	1.03205	.129	.0323	2	1	.125	.0313
1 British peck		554.83	9.0865	16.513	8.256	1.03205	.258	16	8	1	.25
1 British bushel		2,219.34	36.367	66.052	33.026	4.128	1.03205	64	32	4	1

7. Weight (Avoirdupois) Measure Conversion Factors

	Grams	Kilograms	Ounces	Pounds	Metric tons [1]	Short tons	Long tons
1 gram	1	0.001	0.0353	0.0022			
1 kilogram	1,000	1	35.2739	2.2046			
1 ounce	28.349	.0284	1	.0625			
1 pound	453.59	.4536	16	1			
1 metric ton [1]		1,000		2,204.6	1	1.1023	0.9842
1 short ton		907.2		2,000	.9072	1	.8929
1 long ton		1,016		2,240	1.016	1.12	1

[1] Sometimes expressed as millier.

8. Speed Measure Conversion Factors

	Feet per second	Feet per minute	Meters per second	Meters per minute	Statute miles per hour	Kilometers per hour	Knots [1]
1 foot per second	1	60	0.3048	18.288	0.6818	1.097	0.5921
1 foot per minute	.0167	1	.005	.3048	.0114	.0183	.00987
1 meter per second	3.281	196.85	1	60	2.237	3.6	1.9175
1 meter per minute	.0547	3.281	.0167	1	.0373	.06	.03196
1 statute mile per hour	1.467	88	.447	26.8	1	1.6093	.8684
1 kilometer per hour	.911	54.68	.2778	16.667	.6214	1	.5396
1 knot [1]	1.689	101.34	.515	30.9	1.1516	1.853	1

[1] Knot equals 1 nautical mile per hour.

9. Decimal Equivalents

			1/64	0.015625				17/64	0.265625				33/64	0.515625				49/64	0.765625
		1/32		.03125			9/32		.28125			17/32		.53125			25/32		.78125
			3/64	.046875				19/64	.296875				35/64	.546875				51/64	.796875
	1/16			.0625		5/16			.3125		9/16			.5625		13/16			.8125
			5/64	.078125				21/64	.328125				37/64	.578125				53/64	.828125
		3/32		.09375			11/32		.34375			19/32		.59375			27/32		.84375
			7/64	.109375				23/64	.359375				39/64	.609375				55/64	.859375
1/8				.125	3/8				.375	5/8				.625	7/8				.875
			9/64	.140625				25/64	.390625				41/64	.640625				57/64	.890625
		5/32		.15625			13/32		.40625			21/32		.65625			29/32		.90625
			11/64	.171875				27/64	.421875				43/64	.671875				59/64	.921875
	3/16			.1875		7/16			.4375		11/16			.6875		15/16			.9375
			13/64	.203125				29/64	.453125				45/64	.703125				61/64	.953125
		7/32		.21875			15/32		.46875			23/32		.71875			31/32		.96875
			15/64	.234375				31/64	.484375				47/64	.734375				63/64	.984375
1/4				.25	1/2				.5	3/4				.75	1				1.0

10. Relative Effect of Nuclear Bursts

Effect	Airburst	Surface burst	Underwater burst	Underground burst
Antipersonnel effects:				
Blast	1	⅔	½	½
Flash burns	1	⅓	0	0
Burns from secondary fires	1	⅔	½	½
Prompt radiations:				
Gamma	1	1	0	0
Neutron	1	1	0	0
Persistent radiations	0	⅛	¼	1
Material damage:				
Buildings destroyed	1	⅔	½	½
Fires	1	⅔	½	½
Transportation	1	⅔	½	½
Communication	1	⅔	½	½

11. Miscellaneous Conversion Factors and Formulas

Inches to centimeters—multiply by 10 and divide by 4.*

Yards to meters—multiply by 9 and divide by 10.*

Miles to kilometers—multiply by 8 and divide by 5.*

Gallons to liters—multiply by 4 and subtract ⅕ of the number of gallons.*

Pounds to kilograms—multiply by 5 and divide by 11.*

Centigrade to Fahrenheit: $(C° \times \frac{9}{5}) + 32$.

Fahrenheit to centigrade: $(F° - 32) \times \frac{5}{9}$.

Circumference of a circle=diameter×3.1416.

Area of a circle=square of diameter×0.7854, or square of radius×3.1416.

Area of sector of circle=length of arc×radius ÷2.

Area of an ellipse=long axis×short axis×0.7854.

Area of a square or oblong=length×breadth.

Area of a triangle=base×perpendicular÷2.

Area of any right-lined figure of four or more unequal sides is found by dividing it into triangles, finding the area of each, and adding together the areas of the triangles.

Cubic content of a sphere=cube of diameter ×0.5236.

Cubic content of cone or pyramid=⅓×area of base×perpendicular height.

Cubic content of cube=length×breadth× depth.

Cubic content of prism or cylinder=area of base×height.

Surface of sphere=square of diameter× 3.1416.

Surface of cone or pyramid=(½ slant height ×perimeter of base)+area of base.

Surface of a prism or cylinder=(area of two ends)+(length×perimeter).

Surface of cube=sum of areas on all the sides.

*Simplified conversion factors are approximate but are accurate to within 2 percent.

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Motor	3.5*c*	22
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By Order of the Secretary of the Army:

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USA CRD Lab (60)
Units org under fol TOE:
  3–500 (AA–AC) (1)
  17–22 (1)

NG: State AG (3); Corps Arty (2), Div (2), Div Arty (2).
USAR: None.
For explanation of abbreviations used, see AR 320–50.

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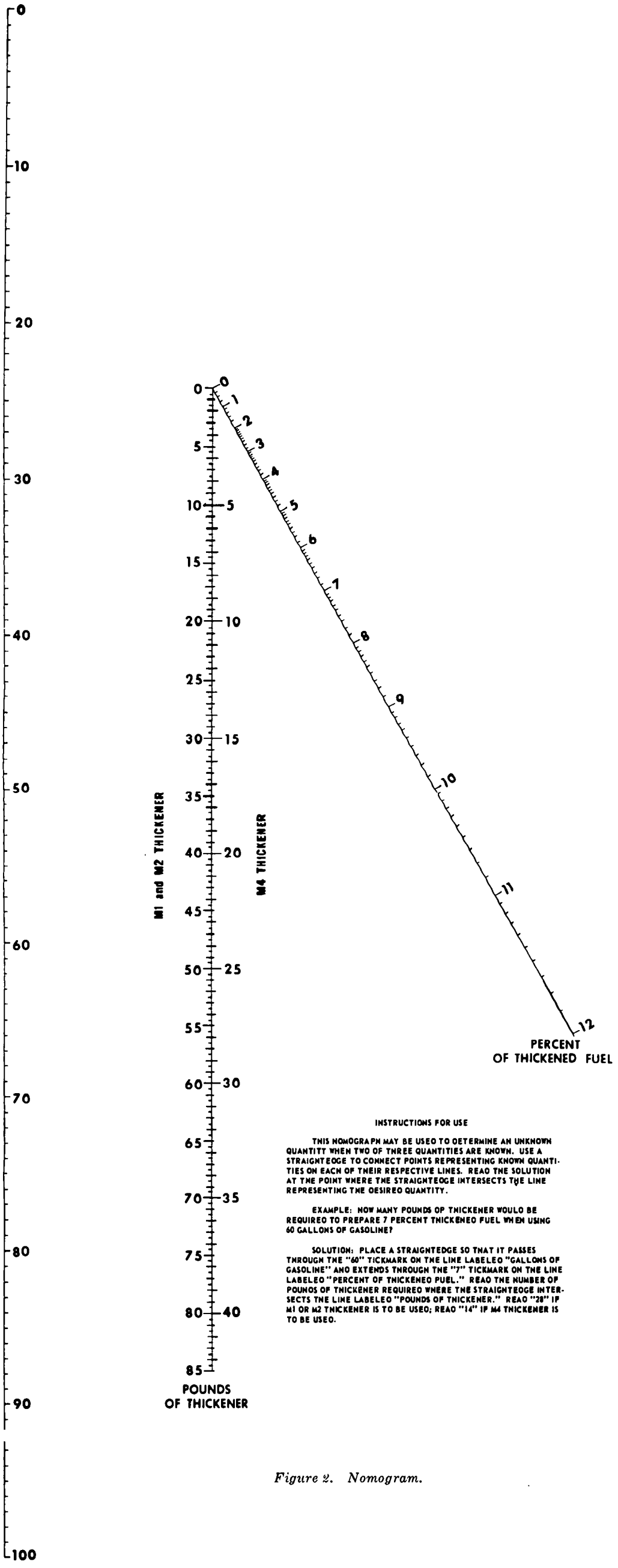
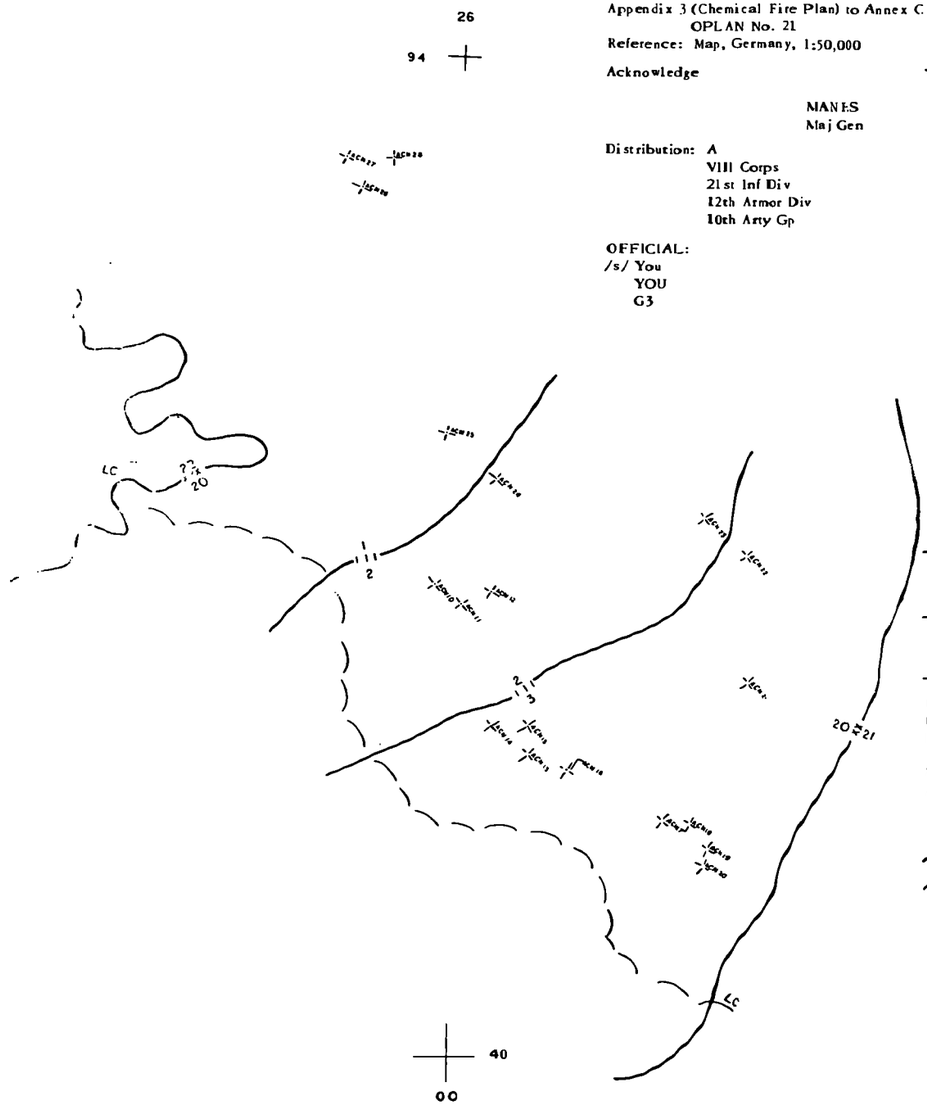


Figure 2. Nomogram.

Figure 2



(Classification)

Cnpy No.
Issuing Headquarters
Place of Issue
Date-Time Group
Message Reference Number

Appendix 3 (Chemical Fire Plan) to Annex C (Fire Support Plan) to OPLAN No. 21
Reference: Map, Germany, 1:50,000

Acknowledge

MANES
Maj Gen

Distribution: A
VIII Corps
21st Inf Div
12th Armor Div
10th Arty Gp

OFFICIAL:
/s/ You
YOU
G3

Munition Computations Based on Avg Weather Conditions
(Recompute if Conditions Change at Firing Time)

Temperature gradient	Neutral
Wind speed and direction	4 mph SW
Temperature	65° F

CHEMICAL TARGET LIST

Target No.	Description	Coordinates (center)	Alt (meters)	Bearing (mils grid north)	Target size: Meters	Target size: Hectares	Wpn/munitions	Firing unit(s)	Remarks, effects desired
ACN-10	Trp in foxholes	25457770	423	2580	200x100	2.	24 rd - GB - 105 Howr.	A/1/7 Arty	Immed casualties
ACN-11	Trp in foxholes	26307705	430	2580	150x100	1.5	24 rd - GB - 105 Howr.	B/1/7 Arty	Immed casualties
ACN-12	Trp in foxholes	27157750	480	2040	350x150	5.25	12 rd - GB - 155 Howr.	A/4/8 Arty	Immed casualties
ACN-13	Trp in foxholes	28427210	340	2400	150x100	1.5	24 rd - GB - 105 Howr.	A/2/9 Arty	Immed casualties
ACN-14	Trp in foxholes	27307300	340	2580	200x100	2.	24 rd - GB - 105 Howr.	B/2/9 Arty	Immed casualties
ACN-15	Trp in foxholes	28457300	360	2580	200x100	2.	24 rd - GB - 105 Howr.	C/2/9 Arty	Immed casualties
ACN-16	Trp in foxholes	29607155	360	2220	500x100	5.	12 rd - GB - 155 Howr.	B/4/8 Arty	Immed casualties
ACN-17	Trp in foxholes	32906970	400	2220	400x150	6.	12 rd - GB - 155 Howr.	C/4/8 Arty	Immed casualties
ACN-18	Trp in foxholes	33856970	410	2140	300x100	3.	12 rd - GB - 155 Howr.	A/4/8 Arty	Immed casualties
ACN-19	Trp in foxholes	34246905	410	2040	200x200	4.	12 rd - GB - 155 Howr.	B/4/8 Arty	Immed casualties
ACN-20	Trp in foxholes	34056845	380	2140	300x100	3.	12 rd - GB - 155 Howr.	C/4/8 Arty	Immed casualties
ACN-21	Entrenchment	35607440	510	2400	1400x700	98	2 Ichr M91 w/M55 rkt GB (1 ripple Ichr)	A/3/5 Arty	Immed casualties
ACN-22	Trp in tanks	35207890	440	1780	400x100	4.	12 rd - GB - 155 Howr.	C/4/8 Arty	Immed casualties
ACN-23	Trp in tanks	34127984	430	2310	200x100	2.	24 rd - GB - 105 Howr.	A/3/5 Arty	Immed casualties
ACP-24	Crossroad	27188130	530	0	100x100	1.	42 rd - HD - 155 Howr.	B/4/8 Arty	Delayed casualties
ACN-25	Trp in tanks	25958270	540	2220	400x150	6.	12 rd - GB - 155 Howr.	A/4/8 Arty	Immed casualties
ACN-26	Trp in tanks	22809080	720	1250	100x100	1.	4 rd - GB - 8-in. Howr.	D/4/8 Arty	Immed casualties
ACN-27	Trp in tanks	22559090	740	1420	100x100	1.	4 rd - GB - 8-in. Howr.	D/4/8 Arty	Immed casualties
ACN-28	Trp in tanks	23709180	730	1250	100x100	1.	4 rd - GB - 8-in. Howr.	D/4/8 Arty	Immed casualties

CHEMICAL SCHEDULE OF FIRES

The heading is blacked out in 2-minute time intervals with respect to H-hour.

Bn	Battery	-18	-16	-14	-12	-10	-8	-6	-4	-2	H	+2
1st How. Bn	A	ACN10 24										
7th Arty	B	ACN11 24										
	C											
4th How. & 8-in. How. Bn	A	ACN12 12		ACN18 12		ACN25 12						
8th Arty	B	ACN16 12		ACN19 12					ACP24 42			
	C	ACN17 12		ACN20 12	ACN22 12							
	D								ACN26 4	ACN27 4	ACN28 4	

(Classification)

Figure 4. Example, chemical fire support plan.

FIELD MANUAL

CHEMICAL CORPS REFERENCE HANDBOOK

CHANGE
No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *31 July 1964*

FM 3-8, 7 May 1963, is changed as follows:

1. Remove old pages and insert new pages as indicated below:

Remove pages	Insert pages
5 through 8	5 through 8
11 through 16	11 through 16
29 through 50	29 through 50
85 and 86	85 and 86
91 and 92	91 and 92
105 through 116	105 through 110.1 111 through 114.2 115 and 116
125 through 130	125 through 130
135 through 140	135 through 140.2
143 through 150	143 through 148
155 and 156	155 through 156.3
161 and 162	161 and 162
169	169
171 through 174	None
Figure 4 (foldin)	Figure 4 (foldin)

2. The following changes will be made in pen and ink:

a. Page 1. Delete title of appendix III, and substitute RESCINDED.

b. Page 17, paragraph 2.9. In the column entitled Equipment, in line 8, change "Pistol cal, .45 semi-auto" to "Pistol, cal .45 auto."

c. Page 18, paragraph 2.9. In the column entitled Equipment:

(1) In line 9, change "Radiacmeter, IM-156/PD" to "Radiacmeter IM-170/PD."

(2) In line 11, change "Radiac set, AN/PDR-27" to "Radiac set, AN/PDR-27J."

d. Page 19, section IV. Delete "and" after 18 Aug 59, insert a comma, and delete the ending parenthesis. Add "and 24 Feb 63)."

e. Page 22, paragraph 3.5. In the column entitled Unit (TOE);

(1) In line 6, change "Cml lab (TOE 3-97D)" to "Cml lab (TOE 3-97E)."

(2) In line 13, change "Cml combat spt co (TOE 3-7D)" to "Cml direct spt co (TOE 3-7E)."

f. Page 65, paragraph 3.17h. In the column entitled Standard color coding system, Base (primary use), opposite last item on the page, Grenade, rifle, green smoke M22A2, change "Light green; black lettering." to "Light green; white lettering."

g. Page 67, paragraph 3.17h. In the column entitled Standard color coding system, Base (primary use):

(1) Opposite first item, Grenade, rifle, green smoke streamer, M23, change "Light green; black lettering." to "Light green; white lettering."

(2) Opposite second item, Grenade, rifle, red smoke, M22A2, change "Light green; black lettering." to "Light green; white lettering."

(3) Opposite third item, Grenade, rifle, red smoke streamer, M23 change "Light green; black lettering." to "Light green; white lettering."

(4) Opposite fifth item, Grenade, rifle, yellow smoke, M22A2, change "Light green; black lettering." to "Light green; white lettering."

(5) Opposite sixth item, Grenade, rifle, yellow smoke streamer, M23, change "Light green; black lettering." to "Light green; white lettering."

h. Page 72, paragraph 3.17h. In column entitled Burning time (min):

(1) Opposite seventh item, Smoke pot, floating, SGF2, AN-M7, change "12 to 17" to" 8 to 13."

(2) Opposite eighth item, Smoke pot, floating, SGF2, Mk 5 Mod 2, change "12 to 17" to "8 to 13."

i. Page 82, paragraph 3.18. In the column entitled Weight, Empty (lb):

(1) Opposite second item, Flamethrower, portable, M2A1-7, Components: Gun, M7, change "4.5" to "4."

(2) Opposite third item, Flamethrower, portable, ABC-M9-7, Components: Gun, M7, change "4.50" to "4."

j. Page 84, paragraph 3.19. In the column entitled Fuel, Discharge rate (gal./second), opposite second

item, Flamethrower, mechanized main armament, turret-mounted, M7A1–6, Components:

(1) With ⅞-in. nozzle, change "6.70" to "5.70."

(2) With ¾-in. nozzle, change "6.20" to "4.90."

k. Page 90, paragraph 4.4b.

(1) Delete from the table SB 3–33, Chemical Corps adopted items of materiel.

(2) Add SB 700–20, Army adopted items of materiel.

l. Page 118, paragraph 4.42:

(1) Add AR 750–10, Materiel Readiness.

(2) Change "AR 750–312, Chemical Corps Technical Assistance Program" to "AR 750–22, Technical Assistance Program."

(3) Change "AR 750–370, Chemical Field Maintenance Shops and Mission" to "AR 750–7, Field Maintenance Shops and Mission."

m. Page 121, paragraph 4.47:

(1) In line 1, change "3–7D, Cml Co, combat spt, 246, [b]42" to "3–7E, Cml co, direct spt, 233, [b]55."

(2) Change footnote [b] to read [b] (Superseded) "Direct labor given is the total for the company; each platoon of the chemical direct support company has a direct labor total of 11."

n. Page 123, paragraph 5.2b. In the last line, change "Coverage per filling - - - 15 square yards" to "Coverage per filling - - - 15 square meters."

o. Page 132, paragraph 5.4a. In the column entitled Application:

(1) Opposite second item, Detrochlorite, in line 8, delete "3-gal. or."

(2) Opposite fifth item, Sodium hypochlorite (household bleach), in line 2, delcte "3-gal. or."

p. Page 133, paragraph 5.4a. In the column entitled Remarks, opposite first item, Calcium hypochlorite (HTH), add "See TM 5–700."

q. Page 133, paragraph 5.4b.

(1) In the column entitled Use, opposite first item, Calcium hypochlorite (HTH), delete "Water purification." and add "Surfaces."

(2) In footnote [b] delete period and add "(detrochlorite mixture)."

r. Page 141, paragraph 5.8. Add subparagraph *c* as follows: *c. M2A2 Impregnating Plant.* The M2A2 plant is an M2A1 plant with a third dryer, yielding an increased operating capacity of 45 percent.

s. Page 159, paragraph 7.2. In the column entitled Mortality (untreated), opposite second item, Brucellosis (undulant fever), delete "Without therapy −2%." Substitute "2% or less. Higher with Melitensis."

t. Page 160, paragraph 7.2. In the column entitled Incubation period, opposite first item, Plague (Black Death), change "2 to 19 days—bubonic plague;" to "2 to 6 days—bubonic plague;".

u. Page 163, paragraph 7.3. In the column entitled Prevention and control:

(1) Opposite second item, Curly top virus of sugar beets, change to "Planting of resistant varieties. Control of insect vector is of major concern."

(2) Opposite third item, Late blight of potato, delete "Chemical control measures are satisfactory but require time, machinery, and money since spraying must be done at 7- to 10-day intervals." Substitute "Major emphasis is on the use of protective fungicides prior to infection."

v. Pages 165 and 166, appendix I.

(1) *Delete:*

(*a*) AR 220–50, Regiments, General Provisions.

(*b*) TM 3–205, Protective Masks and Accessories.

(*c*) TC 3–12, Nuclear Accident Contamination control.

(2) *Add:*

(*a*) AR 700–20, Army Adopted Items of Materiel.

(*b*) FM 3–15, Nuclear Accident Contamination Control.

(*c*) TM 3–225, Radiological Recovery of Fixed Military Installations.

(*d*) TM 3–522–15, Mask, Protective, Field, M9 and Mask, Protective, Field, M9A1.

(*e*) TM 3–4240–202–15, Operator, Organizational, Field, and Depot Maintenance Manual: Mask, Protective, Field, M17.

(3) *Change titles to read as follows:*

(*a*) FM 3–12, Operational Aspects of Radiological Defense.

(*b*) FM 21–40, Small Unit Procedures in Chemical, Biological, and Radiological (CBR) Operations.

(*c*) FM 21–41, Soldier's Handbook for Chemical and Biological Operations and Nuclear Warfare.

w. Page 176, paragraph 5a.

(1) *Delete:*

(*a*) TM 3–205, Protective Masks and Accessories.

(*b*) TC 3–10, Defense Against V–Agents.

(2) *Add:*

(*a*) TM 3–522–15, Mask, Protective, Field, M9 and Mask, Protective, Field, M9A1.

(*b*) TM 3–4240–202–15, Operator, Organizational, Field, and Depot Maintenance Manual: Mask, Protective, Field, M17.

(3) *Change titles to read as follows:*

(*a*) FM 3–12, Operational Aspects of Radiological Defense.

(*b*) FM 21–40, Small Unit Procedures in Chemical, Biological, and Radiological (CBR) Operations.

(*c*) FM 21–41, Soldier's Handbook for Chemical and Biological Operations and Nuclear Warfare.

x. Page 171, appendix III, rescinded.

3. Paragraphs that have been added, changed, or rescinded are indicated by a bold type star.

4. This transmittal sheet should be filed in the front of the manual for reference purposes.

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:

J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

Distribution:

Active Army:

DCSPER (2)
ACSI (2)
DCSLOG (2)
DCSOPS (2)
CORC (2)
CNGB (2)
CRD (1)
COA (1)
CINFO (1)
TIG (1)
CofEngrs (1)
TSG (1)
C/COMMEL (1)
CofT (1)
USA Maint Bd (1)
USCONARC (5)
USAMC (10)
USACDC (2)
ARADCOM (2)
ARADCOM Rgn (1)
OS Maj Comd (10) except
  USAREUR (120)
  USARPAC (150)
LOGCOMD (2)
MDW (1)
Armies (5) except
  First US Army (22)
Corps (3)
Div (2)
Div Arty (1)
Bde (1)
Regt/Gp/Bg (1) except
  Cml Gp (10)
Bn (1) except
  Cml Bn (10)
Co/Btry (1)
Br Svc Sch (1) except
  USA Ord Sch (20)
USMA (20)
USASTC (6)
USA CRD Lab (60)
Units org under fol TOE's:
  3–500 (AA–AC) (1)
  17–22 (1)

NG: State AG (3); Corps Arty (2); Div (2); Div Arty (2).
USAR: None.
For explanation of abbreviations used, see AR 320–50.

CHAPTER 2
ORGANIZATION

Section I. GENERAL

2.1. Types of Units

a. Regular TOE Unit. A regular chemical TOE unit is one that is regularly constituted and activated in accordance with an approved table of organization and equipment. FM 3–50 and FM 3–85 contain the detailed guidance concerning the operation of chemical units.

b. Cellular TOE Unit. A cellular chemical unit (detachment, platoon, or company) is composed of teams provided by the chemical service organization (TOE 3–500), with or without mess, automotive maintenance, and machine record stock accounting teams provided by the composite service organization (TOE 29–500). Each cellular unit is organized to meet a special requirement, and each team of the unit includes personnel and equipment required for the performance of a specific function. FM 3–85 contains a more detailed discussion of these units.

2.2. Unit Categories

a. Category I Unit. A unit organized under TOE whose mission includes the seizing and holding of ground, in addition to that of destroying the enemy. This category also includes those units whose mission is to assist in enemy destruction through support of ground-gaining troops by fire or other tactical support. These units habitually operate in the forward portion of the active combat area.

b. Category II Unit. A unit organized under TOE whose mission includes support and assistance of a nontactical nature to category I units in the forward active portion of the combat area. It is found habitually forward of the army rear boundary and is normally assigned to division, corps, or army.

c. Category III Unit. A unit organized under TOE whose mission includes service and operations in support of a combat area and the operating agencies of a communications zone. The unit is found normally in the communications zone or along the lines of communication leading to it, including the continental United States.

2.3. Type B Strength Column (TOE)

A column in the personnel section of a table of organization and equipment which authorizes only the minimum of United States military command, supervisory, technical, and necessary maintenance personnel positions required to perform the stated mission of the unit when augmented by available non-United States personnel. The capabilities of a type B unit are the same as those of a full strength unit. The number of non-United States personnel required for a type B unit is determined by the major commander to which the unit is assigned and depends upon the capacity of available personnel to produce, the number of work shifts, and other local conditions. Interpreters and translators for a type B unit are provided from teams available to the theater commander.

2.4. Chemical Staff Sections

Information pertaining to the organization and functions of chemical staff sections may be found in FM 101–5.

2.5. Planning Data

The data contained in the following sections of this chapter are the minimum needed by chemical planners. Additional data can be obtained from the appropriate TOE.

★2.6. Regular TOE Units

Designation, TOE No., and date	Strength			Category	Mobility (percent)	Normal assignment	Basis of allocation [a]	Capabilities and remarks [b]
	Full	Reduced	Type B					
Hq & hq det, cml gp, 3-32E, 27 Jul 61, w/consolidated change, 1 Dec 61.	50	43	No	II	50	Assigned to field army or COMMZ; may be attached to Logistical Command B or C.	1 per type field army or COMMZ.	Provides command, control, staff planning, supervision of operations, and administration of 3 to 7 Chemical Corps battalions or Chemical Corps units. Dependent upon other units for mess, medical support, and supplemental motor maintenance.
Hq & hq det, cml bn, svc, army or COMMZ, 3-36E, 7 Mar 61, w/consolidated change, 1 Dec 61.	31	24	No	II	60	Assigned to army, independent corps, or a theater army logistical command. Normally attached to Logistical Command B or C.	1 per 3 to 7 companies.	Provides command, control, staff planning, and administration for attached units consisting of 3 to 7 companies. Dependent upon other units for mess and motor maintenance.
★Cml direct spt co, 3-7E, 11 Feb 63.	233	171	No	II	100	Normally assigned to corps.	1 per corps	At full strength provides five platoons for corps support: *a.* Each platoon can provide the following CBR services for a combat division or for corps troops on a continuing basis: direct maintenance support of chemical equipment, operation of a division chemical distribution point (II and IV), and servicing of portable and mechanized flamethrowers. *b.* Each platoon can provide the following services for a combat division or for corps troops with organic equipment as required on a priority established by the commander of the supported unit: limited decontamination of critical areas and materiel and operation of one personnel decontamination station and CBR monitoring, survey, and reconnaissance to include radiological fallout surveys. This company is self-sufficient when operating as a unit. In normal operations the

								platoons, operating separately, will not be self-sufficient and will be attached to other units for mess. ★
Cml gen spt co, 3-147E, 24 Jan 62.	131	Not adaptable.	No	II	[c] 75	Assigned to field army; may be attached to corps. May be further attached to hq & hq det, cml bn, svc, TOE 3-36, for administration, rear area defense, and damage control.	1 to 4 per corps	Provides the following facilities for approximately one-third of the corps chemical general support requirements (approximately 45,000 troops): receives, classifies, stores, issues, and ships Chemical Corps class II, IV, and V supplies; performs field maintenance on all Chemical Corps equipment; provides CBR decontamination of critical areas and materiel; is adaptable for fire fighting and mobile shower service; expedites the flow of captured enemy CBR materiel and all pertinent reports for intelligence purposes. Dependent upon other units for religious and medical support.
Cml maint co, 3-47E, 1 Mar 61.	99	83	78	II	90	Assigned to army, independent corps, or theater army logistical command. May be attached to hq & hq det, cml bn, svc, TOE 3-36.	2 per type field army and 1 per independent corps or 1 per 100,000 troops.	Performs direct, general, and depot support maintenance on all Chemical Corps equipment utilized by 100,000 troops. Dependent upon other units for religious and medical support.
Cml depot co, 3-67D, 10 Sep 57, w/consolidated changes, 18 Aug 59 and 1 Dec 61.	144	103	81	II	80	Assigned to army or independent corps. May be attached to hq & hq det, cml bn, TOE 3-36.	2 per type field army and 1 per independent corps or 1 per 100,000 troops.	Supplies Chemical Corps munitions and equipment for 100,000 troops; each platoon is capable of operating independently. Dependent upon other units for religious and medical support.
Cml proc co, 3-77E, 7 Dec 59.	93	56	39	III	10	Assigned to a section of the COMMZ.	1 company per 100,000 troops.	Processes approximately 36,000 2-layer uniforms per month when operating continuously from a fixed installation in the COMMZ. Platoons are capable of separate operations. Dependent upon other units for religious and medical support.

See footnotes at end of paragraph.

Designation, TOE No., and date	Strength			Category	Mobility (percent)	Normal assignment	Basis of allocation [a]	Capabilities and remarks [b]
	Full	Reduced	Type B					
★Cml lab, 3-97E, 20 Aug 62.	52	35	No	III	30	Assigned to theater of operations.	1 or more per theater of operations as required.	Provides for theater laboratory examination, evaluation, and identification of materiel, with primary emphasis being placed on the chemical, biological (except identification), and radiological operations aspects; provides for theater laboratory development of temporary devices and measures for chemical, biological, and radiological operations; and analyzes, within capabilities, chemicals and other items procured in the theater to assure that contract specifications are met. Dependent upon other units for mess, motor maintenance, supplemental transportation, religious support, and local security of installations against hostile ground attack.★
Cml depot co, COMMZ 3-117E, 9 Feb 62.	73	60	37	III	Fixed	Assigned to COMMZ; attached as required.	1 per 200,000 total troops or major fraction thereof in the theater.	When labor personnel are furnished by QM service troops or from other labor sources, depending upon workload, this company is capable of receipt, storage, surveillance, and issue of Chemical Corps class II, IV, and V supplies in the COMMZ. Dependent upon other units for medical and religious support, transportation for materials handling equipment, labor sources, and local security of installa-

See footnotes at end of paragraph.

★2.7. Characteristics of Chemical Service Organization (TOE 3-500E, 8 MAY 1962) Teams[1] —Continued

Type	Strength		Capability	Basis of allocation
	Full	Reduced		
			ing its components, use, and effectiveness, and instructing troops in its handling, use, and maintenance when required selects and expedites the flow of captured enemy CBR materiel and pertinent reports for intelligence purposes; locates, evaluates, and exploits those aspects of enemy installations pertinent to the design, construction, research, production, or storage responsibilities of Chemical Corps materiel.	tions as required by subordinate commander to assist the staff chemical officer in fulfilling his technical and scientific intelligence responsibilities.
Mobile Laboratory Team				
Team HA, Mobile Laboratory	20	20	Provides laboratory examination, evaluation, and identification of CBR materiel; develops temporary devices and measures for chemical operations; provides laboratory assistance toward solution of problems of a chemical nature.	Two mobile laboratory teams normally assigned to COMMZ in support of field army.
Munitions Safety Control Team				
Team IA, Munition Safety Control	8	5	*At full strength* provides inspection, evacuation, escort, demilitarization, destruction, deactivation, safety and security services for Chemical Corps munitions and related items. *At reduced strength* provides munitions handling and demolition personnel. The heavy transport capability is reduced.	Assigned as required.
CBR Center Team				
Team JA, CBR Center	5	5	Operates one CBR center or element in which the following operations are performed: implementation of CBR plans; analysis of targets for attack with chemical and biological agents; prediction of fallout from enemy and friendly nuclear strikes, including both the casualty-producing effectiveness of and the degree of hazard from chemical and biological attacks; control and coordination of CBR surveys; maintenance of CBR situation maps; dissemination of CBR information and similar data. Can augment division, corps, and army CBR centers or operate a minimum CBR center in rear area operations.	Assigned as required.

[1] This TOE is not adaptable to Type B organization. Mess teams and automotive maintenance teams will be drawn from TOE 29-500. The degree of mobility must be computed for each specific combination of cellular teams and/or composite units to be used. The teams depend upon other organizations for local security of installations against hostile ground attack. This table does not reflect TOE changes published after November 1963. ★

★2.8. Regular TOE Units

This paragraph does not reflect TOE changes published after November 1963.

Equipment (full strength)	Hq & hq det, cml gp (3-32E)	Hq & hq det, cml bn, svc (3-36E)	Cml direct spt co (3-7E)	Cml gen spt co (3-147E)	Cml maint co (3-47E)	Cml dep co (3-67D)	Cml dep co, COMMZ (3-117E)	Cml proc co (3-77E)	Cml lab (3-97E)	Cml decon co (3-217E)	Hq & hq det, smoke genr bn (3-266E)	Cml smoke genr co (3-267E)
★*Chemical*												
Adapter, line filling, one-ton container						6	5					
Apparatus, filling, field, land mine				2		6						
Beam, hoisting, airplane smoke tank						6						
Beam, hoisting, liquid gas tank						3	3					
Calibrator, radiac, TS-1230/PP									1			
Compressor, reciprocating, power-driven, 3½ CFM			25									
Decontaminating apparatus, portable, 1½-qt			99						2			
Decontaminating apparatus, power-driven, truck-mtd, 400-gal			10	5						12		
Detector kit, chemical agent	1	1	11	1	1	3	4	2	1	16	1	3
Dispensing pump, hand-driven				1		3	1					
Filling line, metal, airplane smoke tank						6	5					
Generator, smoke, mechanical, pulse jet												48
Heater, water, oil			5	5						6		
Hoisting unit, tripod, drum			5			3						
Impregnating plant, clothing								2				
Indicator, outlet valve leakage				1								
Laboratory, chemical, base									1			
Maintenance and repair set, Chemical Corps equipment				1	1							
Mask, gas, all-purpose									5			
Mask, protective, field [a]	50	31	233	131	99	144	73	93	52	115	22	142
Mechanism, valve replacement						3	2					
Mixing and transfer unit, incendiary oil			5									
Respirator, air filtering, paint spray		2		6	6	2	2			2		2
Sampling kit, chemical agent										1		
Service kit, portable flamethrower—riot control agent disperser			25									
Service unit, flamethrower, truck-mtd			5									
Vulcanizer, hot patch, protective mask face-blank				1								
Wrench, valve-removing, M1						3	2					
Wrench, valve-removing, M2						3	2					

★*Engineer*													
Bag, water sterilizing, cotton duck porous, stitched seams, 36 gal			7						1				
Boom, crane, truck-mtd, 25 ft, 2-ton						3							
Boom, crane, truck-mtd, 30 ft, 10-ton							1						
Compressor, reciprocating, power-driven, air, receiver-mtd, gas-driven, 5 CFM. 175 psi				1	1								
Crane-shovel, truck-mtd, abn, 3-ton, ⅜ cu yd						3							
Crane-shovel, truck-mtd, 20-ton, ¾ cu yd							1						
Generator set, .15 kw, skid-mtd												1	
Generator set, 0.5 kw, skid-mtd	1								2				
Generator set, 1.5 kw, skid-mtd		1	1	2	1			1					
Generator set, 3 kw, skid-mtd	1								1				
Generator set, 5 kw, skid-mtd							2		1				
Generator set, 10 kw, skid-mtd					1		1						
Generator set, 30 kw, skid-mtd								4					
Light set, chart, field, portable, command post										1	1	1	
Light set, gen illuminating, 25 outlet	2	1	1	1	1		3	1	3				
Pump, centrifugal, 55 GPM								2					
Pump, centrifugal, 166 GPM				1						3			
Spray outfit, paint, 2 guns w/compressor				1	1								
Sprayer, insect, hand			1						1				
Sprayer, insect, pushcart-mtd			5							3			
Sprayer, insect, skid-mtd			5	5						3			
Supplementary equipment, depot							1						
Tank, fabric, collapsible, 3,000-gal				1				2		3			
Tool kit, blacksmith's, gen				1	1								
Tool kit, carpenter's, engr squad	1			2	1		1	2			1	1	
Tool kit, carpenter's, set 3			5										
Tool kit, pipefitter's, gen				1	1			2	1				
Tool kit, pipefitter's, supplemental								2					
Water purification equipment set, 900 GPH									1				
Welding shop, cargo, trailer-mtd, 300 amp				1	1								
★*Ordnance*													
Automobile, sedan, light									1				
Bayonet, knife, for 7.62-mm rifle			233										
Carbine, cal .30						112							
Gun, machine, cal 7.62-mm		1	6	3		2	2			4		5	
Gun, machine, cal .50	1			1			1					3	
Gun, submachine, cal .45						5							
Launcher, rocket, 3.5-in	1	1	6	1		2	1			1		4	
Mount, tripod, machine gun			6										
Pistol, cal .45	6	3	1	1	1		1	1	3	1	2	1	

See footnotes at end of paragraph.

Equipment (full strength)	Hq & hq det, cml gp (3-32E)	Hq & hq det, cml bn, svc (3-36E)	Cml direct spt co (3-7E)	Cml gen spt co (3-147E)	Cml maint co (3-47E)	Cml dep co (3-67D)	Cml dep co, COMMZ (3-117E)	Cml proc co (3-77E)	Cml lab (3-97E)	Cml decon co (3-217E)	Hq & hq det, smoke genr bn (3-266E)	Cml smoke genr co (3-267E)
Rifle, 7.62-mm	43	28	232	130	98		72	92	[b] 49	114	20	141
Rifle, cal .30, M1						27						
Semitrailer, low bed, 15-ton				2								
Shop set, field maint, machine, basic				1	1							
Shop set, field maint, machine, hv, No. 1, supplemental				1	1							
Tool kit, autmv, fuel and electric system, repairman				1	1							
Tool kit, electrician's, No. 1					3		1					
Tool kit, electrician's, No. 2								2	1			
Tool kit, gen mechanic's (tool kit, autmv maint)	1	1	50	18	18	2	3	6		2	1	5
Tool kit, org maint, No. 1, common			1	1	1	1	1			1		1
Tool kit, org maint, No. 1, supplemental			1	1	1	1	1			1		1
Tool kit, org maint, No. 5, oxygen-acetylene								2				1
Tool kit, org maint, No. 7, hoist and towing			1	1		1					1	1
Trailer, amph, cargo, ¼-ton	8	4	42	4	1	3				4	3	29
Trailer, cargo, ¾-ton			30	1			1				2	
Trailer, cargo, 1½-ton	1	1	20	16	6	3	2			16	1	11
Trailer, tank, water, 1½-ton			1	1	1	1	1			1		3
Truck, cargo, ¾-ton 4x4			30		3		3			3	2	3
Truck, cargo, ¾-ton, 4x4, w/winch				1	1							
Truck, cargo, 2½-ton, 6x6	1	1	6	6	5	7	6	3		4	1	8
Truck, cargo, 2½-ton, 6x6, w/winch			6	5	1	1	1		1	1		7
Truck, tractor, 5-ton				2								
Truck utility, ¼-ton 4x4	8	4	42	4	1	4		1	1	4	3	29
Truck, van, shop, 2½-ton, 6x6				2	2							
★*Quartermaster*												
Can, gasoline, 5-gal [d]	[c] 26	[c] 13	[c] 178	[c] 100	[c] 44	[c] 58	[c] 66	[c] 52	[c] 9	[c] 73	[c] 14	[c] 225
Can, water, 5-gal	[c] 10	[c] 6	[c] 16	[c] 9	[c] 7	28	[c] 5	[c] 19	[c] 10	[c] 8	[c] 4	[c] 9
Crane, whs, mobile, gas, 10,000-lb capacity				1			2					
Machine, sewing, hv duty, electric				2	4							
Machine, shoe patch, electric					1							
Tank and pump, liquid dispensing, truck-mtd												2
Tent, command post	2		1	1			1	1		1	1	1
Tent, gen purpose, medium	5	1	11	1			1			1	1	
Tent, maint				4	2							1
Tent, wall, large		3		5	2	4	3			2		
Tent, wall, small	1											
Tool kit, carpenter's, engr plat		1				3			1	1		
Tractor, whs, 4,000-lb, 144-in. lift							1					

Trailer, whs, 6,000-lb							4						
Truck, fork, 6,000-lb, rough terrain				1			1						
Truck, fork, 10,000-lb, rough terrain							1						
★*Signal*													
Anemometer, ML-497/PM												1	3
Camera, still picture, KS-4			10						1				
Charger, radiac detector, PP-630/PD			30			1							
Charger, radiac detector, PP-1578A/PD	2	2	12	2	2		1	2	2	4	2	2	
Cipher machine, TSEC/KL-7	1	1									1	1	
Cipher machine, TSEC/KW-9	1												
Photographic equipment, PH-383									1				
Radiacmeter, IM-93/UD	6	6	130	8	6	5	2	6	2	14	6	8	
Radiacmeter, IM-147/PD			120										
Radiacmeter, IM-174/PD	4	4	40	2	4		2	4	4	5	4	4	
Radiac set, AN/MDQ-1									1				
Radiac set, AN/PDR-27J			40		1								
Radio set, AN/GRR-5					1								
Radio set, AN/VRC-9	1		18	4						3		8	
Radio set, AN/VRC-17				2	4					1	2	1	
Radio set, AN/VRQ-2		1	2								1	1	
Switchboard, telephone, manual, SB-22/PT	1	1	5	1	1	1	1				1	1	
Switchboard, telephone, manual, SB-993/GT			1										
Telephone set, TA-312/PT	6	6	17	10	5	4	6	3	1	4	5	20	
Teletypewriter set, AN/PGC-1	1												
Terminal telegraph-telephone, AN/TCC-14	1												
Tool kit, photographic repairman, TK-77/GFM									2				
Wind measuring set, AN/GMQ-11											1		

[a] Authorized by TA 20-11.
[b] Selective auto semiautomatic.
[c] Authorized by TA 10-100.
[d] Consideration should be given to reduce allowance for gas cans when other conveyances are authorized, such as fuel trailers, gas trucks, etc. ★

2.9. Chemical Service Organization (TOE 3-500E)

★This paragraph does not reflect TOE changes published after November 1963.

Equipment	Team																	
	Admin & Hq			Supply				Maintenance				Decon			Tech Intel	Mbl Lab	Mun Safety Con		CBR Cen
	AA	AB	AC	BA		BB		EA		EB		FA		FB	GA	HA	IA		JA
				Full	Red.	Full	Red.	Full	Red.	Full	Red.	Full	Red.				Full	Red.	
Chemical																			
Adapter, line filling, one-ton container				2	2	4	2												
Analyzing kit, chemical agent															2	1			
Beam, hoisting, airplane smoke tank				2	2	4	2												
Beam, hoisting, liquid gas tank				2	1	3	2												
Calibrator, radiac, TS-1230(U)/PD																	1	1	
Decontaminating apparatus, power-driven, truck-mtd, 400-gal												3	1	6					
Detector kit, chemical agent		1	1	1		1	1	1	1	1	1	3	1	6	2	3	2	2	
Dispensing pump, hand-driven				1	1	2	1												
Filling line, airplane smoke tank				2	2	4	2												
Hoisting unit, tripod, drum				1	1	1	1												
Laboratory, chemical, mobile, M3																1			
Maintenance and repair set, Chemical Corps equipment								1	1	1	1								
Mask, protective, field [1]	2	4	7	18	12	37	27	20	17	48	32	22	8	41	10	20	8	5	5
Mechanism, valve replacement				1	1	1	1										1	1	
Respirator, air filtering, paint spray										6	6								
Sampling kit, chemical agent															2	1			
Service kit, gas bomb																	1	1	
Wrench, valve-removing, M1				1	1	2	1										2	2	
Wrench, valve-removing, M2				1	1	2	1										2	2	
Engineer																			
Compressor, power-driven, 5 CFM								1	1	1	1								
Generator set, 1 ph, 120 volt, 1.5 kw			1	1	1	1	1	1	1	1	1					1			
Generator set, gasoline engine, 10 kw, skid-mtd						1	1												
Light set, gen illuminating, 25 outlet			1	1	1	1	1	1	1	1	1					1			
Pump, centrifugal, gas-driven, base-mtd, 166 GPM, 2 in., 25-ft head												1	1	2					
Spray outfit, paint, w/compressor										1	1								
Supplementary equipment, depot						1													
Tank, fabric, collapsible, 3,000-gal												1	1	2					
Tool kit, carpenter's, engr plat		1	1	1				1	1			1	1	2	1	1			
Tool kit, carpenter's, engr squad						1	1												

3.6. Weights and Dimensions of Organizational Equipment—Continued

Item	Uncrated					Crated						Remarks
	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)	Weight (lb)	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)	Weight (lb)	No. in container	
Toolkit, pipefitter's, gen	25	14	9	1.8	114	28½	15¾	10⅛	2.63	125	1	
Toolkit, pipefitter's, supplemental.	61½	15	18	9.629	288.2	64½	16½	21¼	13.0	340	1	
Toolkit, precision instrument repair.	31	22	22	8.7	202	34	24	24	9.92	256	1	
Toolkit, sheet metal worker's, set No. 1.						26	20	16	4.81	152.9	8	
Tractor, full tracked, diesel, w/accessories.	215	90	111	1,243	19,180							
Water purification equipment set, portable, 900 GHP, set No. 2.									254.0	4,136	1	
Welding shop, trailer-mtd				420	4,900							
★*Ordnance*												
Automobile, sedan, light	197	74	66	557	3,400							Dimensions and weight will vary with different models and manufacturers.
Bayonet, knife, for 7.62-mm rifle.	11¼				1	19¾	14½	16	2.6	70	50	Outside CONUS, wood box (VCI pack).
Carbine, cal .30	35.6			0.5	5.6	41¾	18½	11¾	5.3	112.0	10	Uncrated weight without magazine.
Demolition equipment set, explosive initiating, electric and nonelectric.				4.5	68							
Galvanometer, blasting, w/case and strap.	5½	4⅜	1 1/16	.022	1.25							
Gun, machine, cal 7.62-mm, M60.	43½				23.16	35¾	13¾	12	3.4	73	1	
Gun, machine, cal .50, hv barrel, M2.	[a] 65				82	69½	9	10⅛	3.7	128	1	Uncrated weight without tripod.

See footnotes at end of paragraph.

3.6. Weights and Dimensions of Organizational Equipment—Continued

Item	Unerated					Crated						Remarks
	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)	Weight (lb)	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)	Weight (lb)	No. in container	
Gun, submachine, cal .45, M3.	2.8	2¾	7¾	.28	8.0	19¾	15¼	17	3.0	128.0	10	Uncrated length stock closed. Uncrated weight without magazine.
Launcher, rocket, 3.5-in., M20A1B1.	60¼	8	13½	2.8	13	36½	33¼	16	11.3	150.00	4	
Machine, blasting, 100 cap capacity.	9	8⅜	18¼	0.79	26.75							
Mount, tripod, machine gun, 7.62-mm, M122.	27	14	------	------	15	34⅝	16¼	13¾	4.48	129	4	
Pistol, auto, cal .45	8⅝	1½	5½	0.5	2.437	33¾	11¾	10⅝	2.4	93	25	
Rifle, cal .30, M1	43⅝	------	------	------	9.5	49	18½	11	6.8	164.0	10	
Rifle, 7.62-mm, M14	44.14	------	------	------	9.1	50⅞	22⅛	12⅞	8.44	210	10	Uncrated weight without bipod.
Semitrailer, low bed, 15-ton, 4-wheel, M172.	406	115	64	1,729	15,500							
Semitrailer, van, cargo, 6-ton, 2-wheel, M119A1.	275	93	133	[c] 1,974	7,180							
Shop set, field maint, autmv, fuel-electrical system, basic.	------	------	------	------	------	------	------	------	137.98	2,422	[b] ( )	
Shop set, field maint, machine, basic.	------	------	------	------	------	------	------	------	243.81	4,433	[b] ( )	
Shop set, field maint, machine, hv.	------	------	------	------	------	------	------	------	288.27	8,358	[b] ( )	
Shop set, field maint, machine, hv, No. 1, supplemental.	------	------	------	------	------	------	------	------	288.85	5,522	[b] ( )	
Toolkit, armorer's	------	------	------	1.11	57							
Toolkit, autmv, fuel-electrical system repairman.	------	------	------	.67	18							
Toolkit, electrician's, No. 1.	------	------	------	------	------	[a] 32	[a] 14½	[a] 15½	4	104	[b] ( )	
Toolkit, electrician's, No. 2.	------	------	------	0.5	10							
Toolkit, gen mechanic's (toolkit, autmv maint).	------	------	------	1.24	42.2							

Toolkit, org maint, No. 1, common.									84.0	1,662	[b] ( )
Toolkit, org maint, No. 1, supplemental.									61.1	1,885	[b] ( )
Toolkit, org maint, No. 2, supplemental.				131	3,076						
Toolkit, org maint, set No. 5, oxygen-acetylene.									5.38	305	[b] ( )
Toolkit, org maint, set No. 7, hoist and towing.									120.0	1,005	[b] ( )
Toolkit, welder's				1	31						
Trailer, amph, cargo, ¼-ton, 2-wheel, M100.	109	58	42	[c] 155.4	565						
Trailer, cargo, ¾-ton, 2-wheel, M101.	147	74	83	[c] 520	1,340						
Trailer, cargo, 1½-ton, 2-wheel, M105A2.	160	83	96	[c] 430	2,650						
Trailer, tank, water, 1½-ton, 2-wheel, 400 gal., M107.	170	88	75	[c] 597	2,280						
Truck, cargo, ¾-ton, 4x4, M37.	185	74	90	[c] 497	5,700						
Truck, cargo, ¾-ton, 4x4, M37, w/winch.	190	74	90	[c] 513	5,950						
Truck, cargo, 2½-ton, 6x6, M34.	262	88	109	[c] 1,094	11,775						
Truck, cargo, 2½-ton, 6x6, M34, w/winch.	275	88	109	[c] 1,150	12,190						
Truck, cargo, 2½-ton, 6x6, M35.	262	96	112	[c] 1,610	12,465						
Truck, cargo, 2½-ton, 6x6, M35, w/winch.	276	96	112	[c] 1,718	12,880						
Truck, cargo, 2½-ton, 6x6, M36.	322	96	125	[c] 2,240	13,500						
Truck, cargo, 2½-ton, 6x6, M36, w/winch.	336	96	125	[c] 2,320	13,915						
Truck, cargo, 2½-ton, 6x6, M35.	255	88	105	[c] 1,412	12,330						
Truck, cargo, 2½-ton, 6x6, M211, w/winch.	270	96	112	[c] 1,167	13,580						
Truck, tractor, 2½-ton, 6x6, M48.	253	94	100	[c] 1,058	11,430						
Truck, tractor, 5-ton, 6x6, M52, w/winch.	273	97	103	[c] 1,342	19,100						

See footnotes at end of paragraph.

3.6. Weights and Dimensions of Organizational Equipment—Continued

Item	Uncrated					Crated						Remarks
	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)	Weight (lb)	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)	Weight (lb)	No. in container	
Truck, utility, ¼-ton, 4x4, M38A1.	139	61	73	[c] 258	2,480							
Truck, utility, ¼-ton, 4x4, M151.	132	63	71	[c] 253	2,273							
Truck, van, shop, 2½-ton, 6x6, M109.	263	99	130	[c] 1,959	15,231							
Truck, van, shop, 2½-ton, 6x6, M220.	267	96	130	[c] 1,940	15,085							
Quartermaster												
Burner, oil stove, tent, M–1941.	----------	-------	--------	2.29	55.4							
Cabinet, spare parts, 11-drawer, steel.	46¾	39	23⁹⁄₁₆	24.9	----------	-------	-------	-------	14.33	197.0	1	
Cabinet, storage assembly, tool.	46¾	38¹³⁄₁₆	23⁹⁄₁₆	24.9	----------	-------	-------	-------	----------	400	1	
Can, gasoline, 5-gal	13¾	6½	18⅜	0.95	9.5							
Can, water, 5-gal	----------	-------	--------	1.4	8							
Container, food, insulated	----------	-------	--------	2.23	18.0							
Conveyor, gravity, roller, 45° curved section, 18 in. wide.	----------	22²³⁄₃₂	7¼	4.05	87.0							
Conveyor, gravity, roller, 10-ft section, 18-in. wide.	120	21	4	5.23	156							
Crane, whs, mobile, gas, 10,000-lb capacity.	295	94	95	1,584	20,800							
Desk, field, empty, fiber composition.	----------	-------	--------	2.7	39							
Desk, field, M–1945	----------	-------	--------	4.3	68							
Desk, field, plywood	19⅜	11¼	14⅝	4.3	54							
Desk, field, plywood	22⅝	25⅞	14½	4.9	----------	-------	-------	-------	10.8	130	2	
Dispensing pump, hand rotary, gasoline/kerosene, 12 GPM.	----------	-------	96									
Heater, duct type, 250,000 BTU.	----------	-------	--------	----------	----------	62.0	30.34	54.25	59.06	623	1	

Heater, immersion type, for cans, corrugated, liquid fuel fired 30 in.	----------	15 (diam)	30	5.5	68						
Heater, space coal or oil, 45,000 BTU.	----------	18⅝ (diam)	18⅝	2.29	59.4	20.75	20.75	46.0	11.5	297	5
Heater, tent, gasoline, 250,000 BTU.	----------	-------	--------	57.9	596						
Heater, water, immersion, gas-operated, liquid fuel fired 37¼ in.	----------	13½ (diam)	37¼	8.98	102						
Machine, sewing, hv duty, electric.	----------	-------	--------	17.42	361.0						
Machine, shoe patch, electric.	----------	-------	--------	11.14	217						
Outfit, officers' mess	----------	-------	--------	2	45						
Paulin, duck, 17x12 ft	204	144	--------	[d] 2.3	57	-------	-------	-------	----------	76	1
Paulin, duck, 40x20 ft	480	240	--------	[d] 6.7	250	-------	-------	-------	----------	332	1
Pump, barrel, rotary, kerosene or gasoline, w/6-ft hose and nozzle.	----------	-------	58	2.44	50						
Range outfit, field, gasoline, M–1937.	----------	-------	--------	----------	----------	-------	-------	-------	18.5	340	1
Safe, field, combination lock.	----------	-------	--------	3	150						
Safe, keylock	17½	17	26	5.9	185						
Stove, gasoline burner, 5,500 BTU.	----------	-------	7.25	----------	----------	-------	-------	-------	.09	21	1
Stove tent	----------	-------	--------	----------	----------	20.75	20.75	46.0	11.5	297	5
Strapping kit, steel strapping, ¾-in. wide, 0.035-in. thick.	----------	-------	--------	8.0	26						
Tank and pump, liquid dispensing, truck-mtd.	----------	-------	--------	----------	----------	202	79	65	602.0	5,125	1
Tent, command post, complete w/pins and poles.	165	120	108	[d] 9.9	257						
Tent, gen purpose, medium, complete w/pins and poles.	396	192	120	[d] 19	455	-------	-------	-------	----------	605	1
Tent, kitchen, flyproof, complete w/pins and poles.	216	144	108	[d] 26	419	-------	-------	-------	29	557	1
Tent, maint, complete w/pins and poles.	322	218	164	[d] 84.3	1,255	-------	-------	-------	90	1,405	1
Tent, wall, large, complete w/pins and poles.	174	168	132	[d] 8.9	275	-------	-------	-------	10	366	1
Tent, wall, small, complete w/pins and poles.	106	110	102	[d] 7.5	115	-------	-------	-------	----------	153	1

See footnotes at end of paragraph.

3.6. Weights and Dimensions of Organizational Equipment—Continued

Item	Uncrated					Crated						Remarks
	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)	Weight (lb)	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)	Weight (lb)	No. in container	
Tractor, whs, 4,000-lb, 144-in. lift.	116	66	62	277	5,800							
Trailer, whs, 4,000-lb	84	36	14	24.5	1,000							
Truck, fork, 4,000-lb 144-in. lift.	119	79	106½	[a] 580	6,500							
Truck, hand, gen utility	56	24										
Truck, hand, 2-wheel, gen utility, curved U-type.	52	18		5.94	18							
Truck, lift, fork, gas, 6,000-lb, pneumatic tires, rough terrain.	204	86	91	868	17,000							
Typewriter, nonportable, 11-in. carriage.									4.13	76	1	
Typewriter, nonportable, 18 to 19-in. carriage.									4.90	80	1	
Typewriter, nonportable, 26 to 27-in. carriage.									8.39	125	1	
Typewriter, portable, w/ carrying case.				1.5	35							
★*Signal*												
Anemometer, ML–497/PM.	8	3½	2⅜	0.03	1.00	16	14	17	2.20	142.0	100	
Axle, RL–27						24	1.75	1.75	0.12	5.5	1	
Calibrating set, radiac, AN/UDM–1A.				43.43	752				48.76	1,025		Packed in 4 boxes and 1 crate.
Calibrator, radiac, TS–784( )/PD.	10⅜	10⅛	5⅜	0.5	6¾							
Camera, still picture, KS–4.	86¾	29⅜	62	91.5	147	90¾	30¾	36	58.2	272	2	
Charger, radiac detector, PP–1578A/PD.	2 5/16	1¼	2 9/10	.004	.5							
Multimeter, AN/URM–105.	6½	4⅛	3 3/32	.051								
Photographic equipment, PH–383.				10.0	333.0				34	505	1	
Printer, PH–129	27	18	51	14.3	80	42	29	23	16.2	185	1	
Radiacmeter, IM–9/PD	3 5/8	7/16	7/16		.13							

Radiacmeter, IM-93/UD	4 7/16	3/4	5/8	.001	.13	18 1/2	18 1/2	16 3/4	4.00	200.00	1,200
Radiacmeter, IM-147/PD.	4 3/4	5/8	5/8	----------	.13						
Radiacmeter, IM-174/PD.	6 1/4	4 1/8	4 7/8	.072	3						
Radiac set, AN/PDR-27	13 1/8	10 5/8	9 5/8	.75	[c] 28						
Radiac set, AN/PDR-27E.	16 3/16	11 1/2	9 21/32	1.02	[c] 28						
Radiac set, AN/PDR-27J.	17	5 1/2	8 1/2	.47	[c] 10.5						
Radiac set, AN/PDR-39( ).	8	6.2	10.4	.298	11						
Radio set, AN/GRC-5	33 5/8	13	14	3.54	[c] 189.5	-------	-------	-------	----------	[a] 252	1
Radio set, AN/GRR-5	46 1/4	15 1/4	27 1/4	11.1	110	50	19	31	17	162	1
Radio set, AN/PRC-6	15 1/2	10 1/4	5 1/2	.52	6	16 1/2	11 1/4	6 1/2	.66	7	1
Radio set, AN/PRC-9	9 1/2	3	10 1/2	.17	26	10	12 1/2	18 3/4	1.3	55	2
Radio set, AN/PRC-10	9 1/2	3	10 1/2	.17	26	10	12 1/2	18 3/4	1.3	55	2
Radio set, AN/VRC-9	18 1/2	13	14	1.95	[c] 87	-------	-------	-------	----------	[a] 116	1
Radio set, AN/VRC-17	25 3/4	13	14	2.71	[c] 127	-------	-------	-------	----------	[a] 169	1
Radio set, AN/VRQ-2	37	13	14	3.9	[c] 200	-------	-------	-------	----------	[a] 267	1
Reel, cable, DR/8	9 1/8	9	9	.43	2.50	44	40 3/4	38	4.92	45.00	12
Reel, unit, RL-31	38 1/2	23	5 1/2	5.00	80.00	39 3/4	32 1/2	6 1/2	6.73	124.00	1
Switchboard, manual, SB-22/PT.	12	12	16 5/16	1.36	36.5	-------	-------	-------	----------	[a] 48.6	1
Switchboard, telephone, manual, SB-993/GT.	13	5	2	.08	4.50						
Telephone set, TA-312-PT.	11 1/2	2 1/4	7 1/2	1.12	9.25						
Teletypewriter set, AN/PGC-1.	----------	-------	-------	----------	----------	30.88	25.88	22.38	10.34	150	1
Terminal, telegraph and telephone, AN/TCC-14.	15.8	11.5	25.75	2.68	70						
Test set, electron tube, TV-7/U.	15 1/2	8 3/4	6 3/4	.50	46.00	22 1/2	12 5/8	11	1.70	60.00	1
Tool equipment, TE-33	----------	-------	-------	----------	----------	8.38	3	1.75	.07	5.5	1
Wind measuring set, AN/GMQ-11:											
Box No. 1	----------	-------	-------	----------	----------	39 1/2	20 3/4	16 5/8	8.80	91.00	
Box No. 2	----------	-------	-------	----------	----------	9 1/2	10 1/2	78 1/2	4.00	77.00	
Total	----------	-------	-------	5.50	57.00	-------	-------	-------	12.80	168.00	
Wire WD-1/TT on wire reel RL-159/UM1.	19 1/4 (diam)	17	-------	2.00	70.00	-------	-------	-------	----------	[a] 93	1
Wire WD-1/TT in dispenser MX-306/G.	13 1/2 (diam)	5 1/2 (thick)	5 1/2	----------	27.00	-------	-------	-------	3.50	130.00	4

See footnotes at end of paragraph.

3.6. Weights and Dimensions of Organizational Equipment—Continued

Item	Unerated					Crated						Remarks
	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)	Weight (lb)	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)	Weight (lb)	No. in container	
Transportation												
Chain assembly, single leg, with pear links and 1 grab hook, 5/8 in. x 16 ft.	192 (min) 195 (max)	------	------	------	------	------	------	------	2.0	90	1	
Tool set, org maint, set No. 4, block and tackle.	------	------	------	1.84	89.5							

[a] Approximate.
[b] One set packed in an unknown number of boxes.
[c] Shipping dimensions. Minimum dimensions to which a completely assembled vehicle may be reduced by lowering cab, top, or windshield, removing body bows, gun mounts, and so forth.
[d] Folded.
[e] With accessories in case. ★

★3.7. Gasoline and Oil Supply Data for Chemical Units

Unit [a]	Fuel and lubricant requirements, motor vehicle consumption in moving unit 100 miles [b]				Gasoline capacity (gal.)			Fuel can data, number of organic 5-gal. fuel cans [c]			
	Vehicle fuel (gal.)	Engine oil (gal.)	Gear lubrication (lb)	Grease miscellaneous (lb)	Vehicle tanks	Total 5-gal. cans	Total vehicle tanks; 5-gal. cans	Kitchens and miscellaneous	Motor vehicles	Total miscellaneous and motor vehicles	Organic kitchens [d]
Hq & hq det, cml gp	96.8	2.4	3.2	2.4	236	140	376	16	12	28	0
Hq & hq det, cml bn, svc	68.4	1.6	2.4	1.6	168	75	243	7	8	15	0
Hq & hq det, cml smoke genr bn	65.3	1.4	2.0	1.6	149	70	219	5	9	14	0
Cml direct spt co	1,198.2	25.2	39.0	28.2	2,784	890	3,674	42	136	178	1
(Direct spt plat)	(228.8)	(4.8)	(7.4)	(5.4)	(530)	(145)	(675)	(5)	(24)	(29)	0
Cml gen spt co	493.4	9.4	21.3	9.9	1,290	500	1,790	52	48	100	1
Cml maint co	255.1	5.0	9.4	5.4	613	240	853	19	29	48	1
Cml depot co	228.4	4.8	8.8	4.8	568	310	878	38	24	62	1
Cml depot co, COMMZ	284	5.4	9.9	6.1	742	390	1,130	22	56	78	1
Cml proc co	889.1	16.0	24.9	20.6	2,797	510	3,307	45	57	102	1
Cml lab	232.9	4.8	9.1	4.7	583	145	728	5	24	29	0
Cml decon co	476.4	9.4	17.1	10.3	990	365	1,355	29	44	73	1
Cml smoke genr co	541.9	12.4	18.7	12.7	1,315	1,125	2,440	166	59	[e] 225	1

[a] Calculations include *nonorganic* transportation required to make units 100 percent mobile. See paragraph 3.5.

[b] These figures are based on highway operations with each vehicle carrying full loads of personnel and equipment. To plan for spillage, evaporation, and small losses, an additional 10 percent total consumption should be added. For cross-country movement, increase amount 2.5 times. (The 10 percent wastage factors need not be applied for cross-country movement.) Fuel consumption data for 2½-ton, 6 x 6 vehicles were calculated for the truck, 2½-ton, 6 x 6, M34.

[c] Amount includes gas cans for nonorganic transportation for 100 percent mobility. The amount includes cans authorized by TA 10-100.

[d] Average daily gasoline consumption (net) is 15 gallons per kitchen.

[e] This figure includes gas cans for basic load of gasoline (2 cans per generator) as fuel for smoke generator operation. The company also has a basic load of 144 drums (55 gal). of fog oil (class III supplies) as fuel for smoke generator operation. The company is also authorized two 600-gal. liquid dispensing tank and pump units. ★

★3.8. Gasoline and Oil Supply Data, Vehicles (Loaded)

Vehicle	Vehicle fuel tank capacity (gal)	Fuel per 100 miles (gal)	Oil per 100 miles (gal)	Gear lubricant per 100 miles (lb)	Miscellaneous grease per 100 miles (lb)
Automobile, sedan, light	16	5.8	.2	.1	.1
Decontaminating apparatus, power-driven, truck-mtd, M3A3 [a]	50	20	.4	.8	.4
Service unit, flamethrower, truck-mtd [a]	50	20	.4	.8	.4
Truck, cargo, ¾-ton, 4x4,—	24	12	.2	.3	.3
Truck, cargo, 2½-ton, 6x6, M34	50	20	.4	.8	.4
Truck, cargo, 2½-ton, 6x6, M35	50	20	.4	.8	.4
Truck, cargo, 2½-ton, 6x6, M135	56	22.2			
Truck, cargo, 2½-ton, 6x6, M211	56	17.2			
Truck, shop van, 2½-ton, M109	50	20	.4	.8	.4
Truck, tractor, 2½-ton, M48	50	22.2	.4	.8	.4
Truck, tractor, 5-ton, M52	110	34	.6	.9	.8
Truck, utility, ¼-ton, 4x4,—	17	7.1	.2	.2	.2

[a] Mounted on M45 chassis. ★

3.9. Movement of Chemical Units by Rail

General information on planning factors for movement of units by rail is given in FM 101–10. Rail movement data may also be found in FM 9–2 and FM 55–15. Dimensions of individual vehicles can be found in TM 9–500. Before computing loading combinations, the computer should check with the transportation officer concerning Interstate Commerce Commission regulations, which vary with the individual type car. When units are to be moved in an oversea area, the computer should obtain from the transportation officer information as to the characteristics of rolling stock of foreign railroads. Spacing requirements for bracing and tying down equipment vary with different types of cars and must be allowed for in computation.

a. Movement of Cellular Unit. Requirements for movement of a cellular type chemical service unit (company, platoon, or detachment) organized with teams from the chemical service organization (TOE 3–500) depend upon the specific combination of teams which comprise the unit.

b. Movement of Organizational Equipment. Railway car requirements are computed on the basis of weights and cubages of crated equipment and on the number and dimensions of the vehicles, which are uncrated. Flat cars are utilized for the transport of vehicles and bulky equipment. A trailer and its prime mover are planned to be shipped together on the same flat car to facilitate loading and unloading. The maximum usable space in a 40-ton box car is considered to be 3,000 cubic feet. Supplies and basic loads are not included in the computation.

★*c. Movement of Chemical Unit Organizational Equipment by Rail.*

Unit	TOE [a]	Organizational equipment (crated) less vehicles [b]		Railway cars required (all TOE equipment)		
		Weight (short tons)	Cubage [c] (cu ft)	Box or stock	40-ft flat	50-ft flat
Hq & hq det, cml gp	3-32E	5.9	557	0.19	5	0
Hq & hq det, cml bn, svc	3-36E	3.6	299	0.10	3	0
Cml direct spt co	3-7E	41.5	5,710	1.90	33	26
(Direct spt plat)		(7.21)	(888)	(0.30)	(5)	(5)
Cml gen spt co	3-147E	31.2	7,796	2.60	13	9
Cml maint co	3-47E	18.4	1,862	0.62	11	0
Cml depot co	3-67D	71.3	905	0.30	7	3
Cml proc co [d]	3-77E	128.0	9,517	0.50	1	[e] 8
Cml lab	3-97E	16.8	2,028	0.68	3	0
Cml depot co, COMMZ	3-117E	24.1	1,663	0.55	4	6
Cml decon co	3-217E	13.5	1,495	0.59	19	1
Hq & hq det, cml smoke genr bn	3-266E	2.5	293	0.10	5	0
Cml smoke genr co	3-267E	21.1	1,935	0.64	28	2
Team AA, plat hq (full strength)	Negligible					
Team AB, plat hq (full strength)	3-500E	0.8	63	0.02	0	1
Team AC, co hq (full strength)	3-500E	1.0	76	0.02	2	0
Team BA, supply (reduced strength)	3-500E	1.8	172	.06	2	0
Team BA, supply (full strength)	3-500E	1.7	278	.09	2	0
Team BB, supply (reduced strength)	3-500E	4.5	312	.10	1	1
Team BB, supply (full strength)	3-500E	10.5	1,155	.39	2	2
Team EA, maint (reduced strength)	3-500E	10.0	1,070	.36	2	0
Team EA, maint (full strength)	3-500E	10.0	1,230	.41	2	1
Team EB, maint (reduced strength)	3-500E	13.1	1,653	.55	4	0
Team EB, maint (full strength)	3-500E	17.5	2,085	.70	2	2
Team FA, decon (reduced strength)	3-500E	1.4	137	.05	1	1
Team FA, decon (full strength)	3-500E	2.0	174	.06	5	0
Team FB, decon (full strength)	3-500E	3.7	304	.10	10	0
Team GA, tech intel (full strength)	3-500E	1.2	127	.04	2	0
Team HA, mobile lab (full strength)	3-500E	3.5	388	.13	1	1
Team IA, munitions safety control (full strength)	3-500E	0.6	45	0.02	1	1
Team JA, CBR center (full strength)	3-500E	0.6	45.3	.02	1	0

[a] This table does not include TOE changes published after November 1963.

[b] Also less trailers and materials handling equipment.

[c] Radios, tools, and so forth, are assumed to be mounted on their vehicles.

[d] Includes two dryers authorized by MWO 3-400-45/1.

[e] Each processing plant requires three 50-ft flat cars and a fractional portion (0.3) of a 40-ft flat car (for the additional dryer). TM 3-409 states that a plant may be loaded in three freight cars (plus 0.3 car for the additional dryer). ★

★*d. Movement of Chemical Unit Personnel by Rail.* The requirements for rail movement include individual equipment of personnel. Coach requirements are computed on the basis of 55 individuals per car. Pullman (standard or tourist) requirements are computed on the basis of two officers or three enlisted men per section. One kitchen-baggage car in which a portion of individual equipment may be loaded is allowed each unit.

Movement of Chemical Unit Personnel by Rail

Unit (TOE) [1]	Personnel	Coach	Pullman (standard or tourist) section [2]	Kitchen-baggage car
Hq & hq det, cml gp (3-32E)	50	0.91	19	1
Hq & hq det, cml bn, svc (3-36E)	31	0.57	12	1
Cml direct spt co (3-7E)	233	4.24	79	1
(Direct spt plat)	(41)	(0.74)	(15)	(1)
Cml gen spt co (3-147E)	131	2.38	45	1
Cml maint co (3-47E)	99	1.80	34	1
Cml depot co (3-67D)	144	2.70	49	1
Cml depot co, COMMZ (3-117E)	73	1.40	25	1
Cml proc co (3-77E)	93	1.70	32	1
Cml lab (3-97E)	52	0.95	19	1
Cml decon co (3-217E)	115	2.10	39	1
Hq & hq det, cml smoke genr bn (3-266E)	22	0.40	9	1
Cml smoke genr co (3-267E)	142	2.60	49	1
Admin and hq team AA (3-500E) (full strength)	2	0.04	1	----------
Admin and hq team AB (3-500E) (full strength)	4	0.08	2	----------
Admin and hq team AC (3-500E) (full strength)	6	0.11	3	----------
Supply team BA (3-500E) (reduced strength)	12	0.22	4	----------
Supply team BA (3-500E) (full strength)	18	0.33	7	----------
Supply team BB (3-500E) (reduced strength)	27	0.49	10	----------
Supply team BB (3-500E) (full strength)	37	0.67	13	----------
Maint team EA (3-500E) (reduced strength)	17	0.31	6	----------
Maint team EA (3-500E) (full strength)	20	0.36	7	----------
Maint team EB (3-500E) (reduced strength)	32	0.58	12	----------
Maint team EB (3-500E) (full strength)	49	0.89	17	----------
Decon team FA (3-500E) (reduced strength)	8	0.15	3	----------
Decon team FA (3-500E) (full strength)	22	0.40	8	----------
Decon team FB (3-500E) (full strength)	41	0.75	14	----------
Tech intel team GA (3-500E) (full strength)	10	0.18	4	----------
Mobile lab team HA (3-500E) (full strength)	20	0.36	8	----------
Munitions safety control team IA (3-500E) (full strength)	20	0.36	8	----------
CBR center team JA (3-500E) (full strength)	5	0.09	2	----------

[1] This table does not include TOE changes published after November 1963.

[2] Tourist pullman: number of sections 13 to 60, depending on type. Standard pullman: 12 sections and drawing room, or 16 sections and no drawing room. ★

3.10. Air Transportation

A general description of the various types of mobilization aircraft (Army and Air Force) and their technical characteristics and performance data are contained in TM 57-210. For considerations governing the employment of air transportation, see FM 100-5. For staff procedures, air movement, tables, and other forms relative to air movements, see FM 7-100, FM 57-100, and TM 57-210. FM 101-10, part I, contains a discussion on the air movement of supplies.

a. Army Aircraft. Army aircraft, both fixed-wing and rotary-wing, are employed to move cargo, personnel, and equipment within the combat zone. Since performance standards are affected by many variables, the Army aviation staff officer should be consulted for accurate, detailed computations to meet specific requirements. Army aircraft charac-

teristics, aircraft planning factors, and the methods for determining Army aircraft requirements are contained in FM 101-10, part I.

b. Air Force Transport Aircraft. For general considerations and procedures governing the employment of Air Force transport aircraft in joint operations, see FM's 100-5; 101-5; 57-10; 57-100; and 101-10, parts I and III.

c. Aircraft Requirements.

(1) Aircraft requirements listed in *d* below reflect the number of sorties required to transport the various units. Aircraft requirements are based on the following assumed allowable cargo loads:

Type aircraft	*Allowable cargo load (lb)*
C-130, medium transport airplane	[a] 29,500
C-124, heavy transport airplane	[b] 55,000
C-133, heavy transport airplane	[b] 95,418

[a] 1,000-nautical mile radius. If aircraft can be refueled at destination, the weight can be increased (see TM 57-210).
[b] 1,000-nautical mile range.

(2) In determining aircraft requirements, the "weight method" (as opposed to the "type load method") (see TM 57-210) has been utilized. Units have been loaded administratively rather than tactically. The aircraft requirements are based on the entire unit being transported in each type of aircraft.

(3) Unless otherwise indicated, all units are moved at 100 percent personnel and equipment TOE strength. The gross weight (short tons) of a unit is the sum of the combined weights of personnel, organizational equipment (uncrated), class I supplies for 3 days, class III supplies for 300 miles, and a basic load of class V supplies. The basic load of chemical nontoxic ammunition (SB 3-39) is not included in the computations. Prescribed loads of repair parts, depot stocks, and other prescribed loads of supplies other than fog oil for smoke units are also not included in the computations. An average weight of 240 pounds was assumed for each man. Class I supply is based on 3 days of supply to accompany each unit, with an average of 6.6 pounds per man per day. Class III supplies are based upon the weight of gasoline, oil, and lubricants required to operate vehicles a minimum of 300 miles. Class V supply weights for service units are based on a basic load for a unit with the mission of providing normal security.

★*d. Movement of Chemical Units by Air* (This listing does not include TOE changes published after November 1963).

Unit	TOE	Weight of equipment (uncrated) (short tons)	Weight of personnel and supplies (short tons)	Gross weight (short tons)	Aircraft requirements		
					C-130 only	C-124 only	C-133 only
Hq & hq det, cml gp	3-32E	26.1	7.9	34.0	3	2	1
Hq & hq det, cml bn, svc	3-36E	17.1	4.7	21.8	2	1	1
Cml direct spt co	3-7E	417.2	44.5	461.7	32	17	9
(Direct spt plat)		(78.3)	(7.5)	(85.8)	(6)	(3)	(2)
Cml gen spt co	3-147E	242.7	21.8	264.5	[a, b, c] 16	10	6
Cml maint co	3-47E	94.3	15.5	109.8	[a] 7	4	3
Cml depo co	3-67D	109.1	20.9	130.0	[d] 7	5	3
Cml depot co, COMMZ	3-117E	129.2	11.6	140.8	[e] 10	5	3
Cml decon co	3-217E	166.3	19.8	186.1	13	7	4
Hq & hq det, cml smoke genr bn	3-266E	20.6	3.6	24.2	2	1	1
Cml smoke genr co	3-267E	190.3	[f] 79.7	270.0	19	10	6
Team AA, plat hq (full strength)	3-500E	Negligible					
Team AB, plat hq (full strength)	3-500E	11.6	0.8	12.4	1	[g] ( )	[g] ( )
Team AC, co hq (full strength)	3-500E	13.1	1.3	14.4	1	[g] ( )	[g] ( )
Team BA, supply (reduced strength)	3-500E	12.9	2.2	15.1	1	1	[g] ( )
Team BA, supply (full strength)	3-500E	21.8	3.0	24.9	[b] 1	1	[g] ( )
Team BB, supply (reduced strength)	3-500E	28.5	4.3	32.8	[b] 2	2	1
Team BB, supply (full strength)	3-500E	49.9	6.2	56.1	[b] 3	2	2
Team EA, maint (reduced strength)	3-500E	26.6	2.9	29.5	[b] 2	2	1

See footnotes at end of paragraph.

Movement of Chemical Units by Air—Continued

Unit	TOE	Weight of equipment (uncrated) (short tons)	Weight of personnel and supplies (short tons)	Gross weight (short tons)	Aircraft requirements		
					C-130 only	C-124 only	C-133 only
Team EA, maint (full strength)	3-500E	29.5	3.5	33.0	[h] 2	2	1
Team EB, maint (reduced strength)	3-500E	42.8	5.7	48.5	[h] 3	2	1
Team EB, maint (full strength)	3-500E	54.4	8.0	62.4	[a] 3	3	2
Team FA, decon (reduced strength)	3-500E	19.0	1.7	20.7	2	1	[g] ( )
Team FA, decon (full strength)	3-500E	52.5	4.6	57.1	4	3	2
Team FB, decon (full strength)	3-500E	87.3	8.7	96.0	7	4	3
Team GA, tech intel (full strength)	3-500E	13.8	2.0	15.8	2	2	[g] ( )
Team HA, mobile lab (full strength)	3-500E	15.8	3.3	19.1	2	1	[g] ( )
Team IA, munitions safety control (full strength)	3-500E	18.3	1.8	20.1	[i] 1	1	[g] ( )
Team JA, CBR center (full strength)	3-500E	3.9	.8	4.7	[g] ( )	[g] ( )	[g] ( )

[a] Does not include two trucks, shop van, 2½-ton.
[b] Does not include No. 6,000 fork lift.
[c] Does not include one 10,000-lb mobile crane.
[d] Does not include three 3-ton crane-shovels, truck-mounted.
[e] Does not include two 10,000-lb mobile cranes and one 20-ton crane-shovel.
[f] Includes 52.7 tons of fog oil (basic load).
[g] Not enough weight to make efficient use of these aircraft.
[h] Does not include one truck, shop van, 2½-ton.
[i] Does not include one 6-ton semi-van and tractor. ★

★3.11. Water Movement

Amphibious force planning factors and characteristics of amphibious force vessels and craft are contained in FM 101-10. Capacities and characteristics of ocean-going vessels are also contained in FM 101-10. The following data (measurement tons) can be used in calculating vessel requirements.

Movement of Chemical Units by Water

Unit	TOE [1]	Weight of organizational equipment (short tons) [2]	Cubage (measurement tons) [3]
Hq & hq det, cml gp	3-32E	28.1	148.7
Hq & hq det, cml bn, svc	3-36E	18.4	100.8
Cml direct spt co	3-7E	423.2	2,473.5
(Direct spt plat)		(79.8)	(471.9)
Cml gen spt co	3-147E	248.5	1,439
Cml maint co	3-47E	97.6	559.2
Cml depot co	3-67D	124.6	547.4
Cml proc co [4]	3-77E	148.0	365.4
Cml lab	3-97E	26.0	111.4
Cml depot co, COMMZ	3-117E	133.5	629.1
Cml decon co	3-217E	170.3	941.1
Hq & hq det, cml smoke genr bn	3-266E	21.2	155.8
Cml smoke genr co	3-267E	195.2	1,141.8
Team AA (plat hq) (full strength)	3-500E	Negligible	
Team AB (plat hq) (full strength)	3-500E	12.1	61.6
Team AC (co hq) (full strength)	3-500E	13.9	72.3
Team BA (supply) (reduced strength)	3-500E	13.5	137.6
Team BA (supply) (full strength)	3-500E	22.7	160.7
Team BB (supply) (reduced strength)	3-500E	29.5	162.8
Team BB (supply) (full strength)	3-500E	51.9	317.2
Team EA (maint) (reduced strength)	3-500E	27.3	149.6
Team EA (maint) (full strength)	3-500E	30.2	166.2
Team EB (maint) (reduced strength)	3-500E	44.2	255.8
Team EB (maint) (full strength)	3-500E	56.2	312.1
Team FA (decon) (reduced strength)	3-500E	19.5	114.7
Team FA (decon) (full strength)	3-500E	53.2	320.1
Team FB (decon) (full strength)	3-500E	88.6	618.3
Team GA (tech intel) (full strength)	3-500E	14.1	101.6
Team HA (mobile lab) (full strength)	3-500E	16.1	99.4
Team IA (munitions safety control) (full strength)	3-500E	18.6	162.7
Team JA (CBR team) (full strength)	3-500E	4.1	26.6

[1] This table does not include TOE changes published after November 1963.
[2] All items except vehicles with tools and radios, trailers, and materials handling equipment are crated.
[3] Measurement ton = 40 cubic feet (ship ton).
[4] Includes two dryers authorized by MWO 3-409-45/1. ★

Section III. CHEMICAL TRAINING

★3.12. References

Training publications are listed in DA Pam 310-3. For information pertaining to tables of allowances for training, see DA Pam 310-7. Information pertaining to chemical, biological, and nuclear training exercises and integrated training is given in FM 21-48. Small unit procedures in CBR operations are outlined in detail in FM 21-40. Individual procedures in CBR defense are outlined in FM 21-41.★

★3.13. Training of Individuals

ATP 21-114 allots 4 hours to chemical and biological operations and nuclear warfare training during the basic combat training phase. This training is outlined in ASubjScd 21-6. Standards of proficiency for individuals are given in appendix II, FM 21-41.★

★3.14. Training of Units

Units below division level must have selected personnel receive specialized training to assist the commander in fulfilling his responsibilities in CBR operations. All units of the Army are trained in defense against CBR attack in accordance with FM 21-40 and other pertinent publications. Training in employment of CBR weapons is in accordance with FM 3-5, FM 3-10, and FM 101-31.★

3.15. CBR Proficiency Testing

Training tests involving chemical and biological operations and nuclear warfare must be designed to require prompt and correct decisions, proper sequence of actions, and, above all, emphasis on continuing the mission. Information on the techniques of testing is given in FM 21-6 and FM 21-48.

★3.15.1. CBR Annex to SOP

Information pertaining to CBR annexes to SOP's can be found in FM 21-40, appendix IV; FM 7-20, appendix VII; and FM 61-100, appendix III. The sample annexes contained in these publications can be used as guides in the preparation of SOP's. Procedures outlined are based on current doctrine and are not intended to establish doctrine.★

Section IV. CHARACTERISTICS OF CHEMICAL AGENTS, CHEMICAL-FILLED MUNITIONS, AND CHEMICAL EQUIPMENT

★3.16. Characteristics of Chemical Agents

Name and symbol	Odor	Use and physiological classifications	State at 20° C.	Effect on body—
Distilled mustard, HD.[1]	Like garlic or horseradish.	Casualty agent. Blister agent.	Colorless to pale yellow liquid.	Injures eyes and lungs; blisters skin.
Mustard, H [1]	Like garlic or horseradish.	Casualty agent. Blister agent.	Dark liquid	Injures eyes and lungs; blisters skin.
Nitrogen mustard, HN1.[1]	Odorless to faint fishy.	Casualty agent. Blister agent.	Dark liquid	Injures eyes and lungs; blisters skin.
Mustard T-mixture, HT.[1,2]	Like garlic or horseradish.	Casualty agent. Blister agent.	Clear to pale yellow liquid.	Injures eyes and lungs; blisters skin.
Lewisite, L [1]	Irritating, unpleasant; faintly like geraniums.	Casualty agent. Blister agent.	Dark, oily, liquid	Injures eyes and blisters skin. Arsenic poisoning.
Phosgene oxime, CX	Odor disagreeable	Casualty agent (fast acting). Blister agent.	Crystalline solid (water soluble).	Irritates eyes and nose; forms a wheal on skin surfaces.
GA [1]	Faintly fruity, sweetish (odor because of impurities).	Casualty agent (fast acting). Nerve agent.	Colorless to brown liquid.	Causes blurred vision with pinpointing of pupils, skin and eye spasms, difficult breathing, tight chest, salivation, mental confusion, convulsions.
GB [1]	Odor scarcely detectable; none when pure.	Casualty agent (fast acting). Nerve agent.	Colorless liquid	Causes blurred vision with pinpointing of pupils, skin and eye spasms, difficult breathing, tight chest, salivation, mental confusion, convulsions.
VX	Odorless	Casualty agent. Nerve agent.	Colorless liquid	Similar to effects from GB.

See footnotes at end of paragraph.

Persistency effect	Possible dispersion methods	Stability in storage	Temperature effects	Munitions used in—
Summer: 3 or 4 days in open; 1 week in woods. Winter: several weeks.	Artillery, bomb, land mine, mortar, rocket, spray.	Very stable	Freezes at 14.4° C. Boils at 227.8° C.	Bombs: M70A1. 1-gal. land mine. 4.2-in. mortar cartridge: M2, M2A1. 105-mm how. cartridge: M60. 155-mm how. projectile: M110. 155-mm gun projectile: M104. Aircraft smoke tank: M10.
Summer: 3 or 4 days in open; 1 week in woods. Winter: several weeks.	Artillery, bomb, land mine, mortar, rocket, spray.	Decomposes because of impurities; produces pressure.	Freezes at approx. 8.89° C. Boils above 204° C.	Bombs: M70. 1-gal. land mine. 4.2-in. mortar cartridge: M2. 155-mm how. projectile: M110. Aircraft smoke tank: M10.
Summer: 3 or 4 days in open; 1 week in woods. Winter: serveral weeks.	Arillery, bomb, land mine, mortar, rocket, spray.	Adequate	Freezes at −34.2° C. Boils at 85° C. and 10 mm Hg.	
Summer: more persistent than HD or H. Winter: more persistent than HD or H.	Artillery, bomb, land mine, mortar, rocket, spray.	Stable in steel and glass.	Freezes at approx. 1.1° C. Boils above 228° C.	4.2-in. mortar cartridge: M2.
Summer: 1 day in open; 2 or 3 days in woods. Winter: 1 week or longer.	Artillery, bomb, land mine, mortar, roeket, spray.	Stable	Freezes at −18.2° C. Boils at 190° C.	
			Melts at 40° C. Boils at 54° C. and 28 mm Hg.	
Summer: 10 minutes-24 hours. Winter: 10 minutes-24 hours.	Artillery, bomb, land mine, mortar, rocket, spray.	Stable in steel	Freezes at −48.9° to −50° C. Boils at 246° C.	
Summer: 10 minutes-12 hours. Winter: 10 minutes-12 hours.	Artillery, bomb, land mine, mortar, roeket, spray.	Stable when pure.	Freezes at −56° C. Boils at 147° C.	Roeket: M55. Bomb: MC-1, M125, M125A1. 105-mm how. cartridge: M360. 155-mm how. projeetile: M121, M121A1. 155-mm gun projectile: M122. 8-in. how, projectile: M426. 762-mm rocket: M79.
Normally long duration of effectiveness.	Roekets, mines, artillery, mortars.			Rocket: M55. Land mine: ABC-M23. 155-mm how, projectile: M121A1. 8-in. how. projectile: M426.

3.16. Characteristics of Chemical Agents—Continued

Name and symbol	Odor	Use and physiological classifications	State at 20° C.	Effect on body
Hydrocyanic acid (hydrogen cyanide), AC.	Like peach kernels	Casualty agent (fast acting). Blood agent.	Colorless liquid	Causes dizziness, convulsions, paralysis, coma, collapse.
Cyanogen chloride, CK.[3]	Somewhat like AC, but irritating.	Casualty agent (fast acting). Blood agent.	Colorless gas	Injures lungs; causes convulsions, paralysis respiratory arrest.
Phosgene, CG.[3]	Like new mown hay or green corn.	Casualty agent (delayed action). Choking agent.	Colorless gas	Injures lungs, causing accumulation of fluid.
Chloroacetophenone, CN.[3]	Fragrant	Riot control agent. Tear agent.	Solid	Causes tears and irritates skin; no permanent injury.
Chloroacetophenone solution, CNB.[3]	Like benzene	Riot control agent. Tear agent.	Liquid	Causes tears and irritates skin.
Chloroacetophenone solution, CNC.[3]	Like chloroform	Riot control agent. Tear agent.	Liquid	Causes tears and irritates skin.
Chloroacetophenone solution, CNS.[3]	Like flypaper	Riot control agent. Tear agent.	Liquid	Causes violent tears and irritates skin, acts as vomiting and choking agent also.
Adamsite, DM.[2,3,4]	Odorless	Riot control agent. Vomiting agent.	Yellow to green solid	Headache, nausea, violent sneezing, temporary mental depression.
O-chlorobenzalmalononitrile, CS.	Like pepper	Riot control agent. Tear agent.	White to cream solid	Causes tears, irritates skin, and acts as a vomiting agent. May cause temporary pain in the chest.
Diphenylchloroarsine, DA.[2,3]	Odorless	Riot control agent. Vomiting agent.	White to brown solid	Causes headache, nausea, vomiting, sneezing.
BZ		Incapacitating agent (delayed acting).	White solid	Causes temporary slowing of mental and physical activity, disorientation, and hallucinations.

See footnotes at end of paragraph.

Persistency effect	Possible dispersion methods	Stability in storage	Temperature effects	Munitions used in—
Summer: 1–10 minutes. Winter: several hours.	----------	Stable if pure or stabilized, often burns on shell burst.	Freezes at −13.9° C. Boils at 25.7° C.	
5–10 minutes	Artillery, bomb, mortar, rocket.	Unstable; tends to polymerize, sometimes with explosive violence.	Freezes at −6.7 to −5° C. Boils at 13° C.	Bombs: AN–M78, AN–M79. 4.2-in. mortar cartridge: M2, M2A1.
Summer: 5 minutes in open; 10 minutes in woods. Winter: 10 minutes in open; 20 minutes in woods.	Artillery, bomb, mortar, rocket.	Stable in steel if CG is dry.	Freezes at −127.5° C. Boils at 7.48° C.	Bombs: AN–M78, AN–M79. 4.2-in. mortar cartridge: M2.
Summer: 1–10 minutes. Winter: 1–10 minutes.	Candle, capsule, grenade, mortar, pellet, mechanical disperser.	Stable	Freezes at 54–55° C. Boils at 244–245° C.	Grenades: M6 (CN–DM), M6A1 (CN–DM), M7, M7A1, M25A1, M25A2. Capsule: CN. Riot control agent dispersers (CN1). Pellet: M2.
Summer: 1–10 minutes. Winter: 1–10 minutes.	Artillery, bomb, grenade, mortar, spray.	Adequate	Freezes at −7° to −30° C. Boils from 75° to 247° C.	Aircraft smoke tank: M10.
Summer: 1–10 minutes. Winter: 1–10 minutes.	Artillery, bomb, grenade, mortar, spray.	Adequate	Freezes at approx 0° C. Boils from 60° to 247° C.	Aircraft smoke tank: M10.
Summer: 1 minute–1 hour. Winter: 1 minute–1 hour.	Artillery, bomb, grenade, mortar, spray.	Adequate	Freezes at approx 1.7° C. Boils from 60° to 247° C.	
Summer: 1–10 minutes. Winter: 1–10 minutes.	Candle, grenade, mechanical disperser.	Stable in steel or glass.	Freezes at 195° C. Boils at 410° C.	Grenade: M6, M6A1, M25A2. Riot control agent dispersers (DM1).
	Candle, grenade, mechanical disperser.	Stable	Freezes at 93° to 95° C. Boils at 310° to 315° C.	Grenades: M7A1, M7A2, M25A2. Riot control agent dispersers (CS1).
Summer: 1–10 minutes. Winter: 1–10 minutes.	Candle, grenade	Stable when pure.	Freezes at 43.89° C. Boils at 307.2° C.	
	Bomb, thermal generator.	----------	----------	Bomb: M138. Bomb clusters: M43, M44. BZ generator: M16.

3.16. Characteristics of Chemical Agents—Continued

Name and symbol	Odor	Use and physiological classifications	State at 20° C.	Effect on body
Hexachloroethane-zinc oxide mixture, HC.[5]	Slightly acrid	Screening smoke	Solid	30-minute exposure to ordinary concentration harmless; 1-hour exposure to heavy concentration may irritate nose and throat and cause illness. Heavy metal poisoning possible with prolonged exposure.
Titanium tetrachloride, FM.[5]	Acrid or pungent	Screening smoke	Colorless liquid	Smoke slightly irritates nose and throat; spray droplets or liquid injures eyes; liquid burns skin.
Sulfur trioxide in chlorosulfonic acid, FS.[5]	Acrid	Screening smoke	Liquid	Smoke not toxic in ordinary concentration; high concentration irritates eyes, throat, and chest and may cause illness; liquid is corrosive and burns skin.
Fog oil SGF2 [6]	Like petroleum oil	Screening smoke	Liquid	Prolonged exposure can irritate lungs and throat.
White phosphorus, WP.[7]	Like burning matches	Screening smoke	Pale yellow, translucent solid.	Smoke is harmless; solid particles burn flesh.

See footnotes at end of paragraph.

Persistency effect	Possible dispersion methods	Stability in storage	Temperature effects	Munitions used in—
Subject to atmospheric conditions.	Artillery, bomb, grenade, mortar, pot, rocket.	Stable in steel drums; is fire hazard with moisture.	None for mixture.	Grenade: AN-M8. 105-mm how. cartridge: M84. 155-mm how. projectile: M116B1. Smoke pot: M4A2, M5.
Subject to atmospheric conditions.	Artillery, mortar, spray.	Stable in absence of moisture.	Freezes at −30° C. Boils at 135° C.	4.2-in. mortar cartridge: M2. Aircraft smoke tank: M10.
Evaporates immediately; subject to atmospheric conditions.	Artillery, mortar, rocket, spray.	Stable in absence of moisture.	Freezes below −30° C. Decomposes at 80° C.	Aircraft smoke tank: M10; MK 12, Mod 0.
Subject to atmospheric conditions.	Smoke generator, grenade, pots.	Very stable	Pours at −40° C. Ignites at about 207° C.	Smoke generator: M3A3. Smoke candle: M6. Smoke pots: AN-M7, MK 5.
Subject to atmospheric conditions.	Artillery, bomb, grenade, mortar, rocket.	Stable in steel drums when not contacted by oxygen or air.	Freezes at 44° C. Boils at 290° C.	Bombs: M47A3. Hand grenade: M15, M34. Rifle grenade: M19A1. Igniter: M16. 3.5-in. rocket: M30. 4.2-in. mortar cartridge: M2, M2A1, M328, M328B1. 4.5-in. rocket: MK 10. 5-in. projectile: MK 30, MK 48. 5-in. rocket: MK 30. 6-in. projectile: MK 41. 57-mm rifle cartridge: M308A1. 60-mm mortar cartridge: M302. 75-mm rifle cartridge: M311. 81-mm mortar cartridge: M57A1, M370. 90-mm gun cartridge: M313, M313C. 105-mm how. cartridge: M60. 155-mm how. projectile: M110, M105. 155-mm gun projectile: M104. 76-mm cartridge: M361. 120-mm projectile: M357.

3.16. Characteristics of Chemical Agents—Continued

Name and symbol	Odor	Use and physiological classifications	State at 20° C.	Effect on body
Plasticized white phosphorus, PWP.	Like burning matches	Screening smoke	Finely divided WP in gel of rubber and xylene.	Same effect on body as WP.
Green smoke, GS	Acrid	Signaling smoke		
Red smoke, RS	Acrid	Signaling smoke		
Violet smoke, VS	Acrid	Signaling smoke		
Yellow smoke, YS	Acrid	Signaling smoke		
Incendiary mixture PT1[8], PTV.[9]	Like petroleum oil	Incendiary	Soft, black, elastic, homogeneous mixture.	Can cause severe burns when ignited.
Incendiary oil (isobutyl methacrylate), IM.[10]	Like gasoline	Incendiary	Gel	Can cause severe burns when ignited.
Incendiary oil, NP [11]	Like petroleum oil	Incendiary	Gel	Can cause severe burns when ignited.
Incendiary oil, NP2 [12]	Like petroleum oil	Incendiary	Gel	Can cause severe burns when ignited.
Incendiary oil, NP3 [13]	Like kerosene	Incendiary	Liquid	Can cause severe burns when ignited.
Thermite, TH1	None	Incendiary	Grayish solid	Can cause severe burns when ignited.
Thermate, TH3	None	Incendiary	Grayish solid	Can cause severe burns when ignited.
Thermate, TH4	None	Incendiary	Grayish solid	Can cause severe burns when ignited.

[1] Requires protective clothing and mask.
[2] Decomposes below boiling point at normal atmospheric pressure.
[3] Requires protective mask.
[4] This material contains arsenic; therefore, it should be not used in closed spaces.
[5] Mask required in dense concentrations.
[6] Used when air temperature is between −18° and 5° C.
[7] Secondary tactical classification is an antipersonnel agent; agent also has some incendiary effect.
[8] PT1 is composed of petroleum oil, magnesium waste, and isobutyl-methacrylate polymer as thickner.
[9] PTV is composed of petroleum oil, magnesium, and polybutadiene.
[10] Incendiary oil, IM, is composed largely of isobutyl-methacrylate and gasoline.
[11] NP is composed of petroleum oil and napalm (M1 thickener).
[12] NP2 is composed of petroleum oil and antiagglomerated napalm (M2 thickener).
[13] NP3 is composed of kerosene and napalm. ★

Maximum effective range		Pressure		Remarks
Thickened fuel (meters)	Unthickened fuel (meters)	Pressure container (psi)	Fuel container (operating pressure) (psi)	
230	Not recommended.	3,000	325	Installed in M48A1 medium tank for use by Marine Corps; flame fuel ignited by spark plug and atomized gasoline and/or secondary fuel. Marine Corps Manual OR1D-MM-7005.
				Mounted in dummy 90-mm gun tube.
230	Not recommended.			
185	Not recommended.			
				Includes fuel and pressure containers located in tank turret; pressure containers charged with compressed air or nitrogen.[1]
Approx. 230	Not recommended.	3,000	325	Installed in M48A2 medium tank; flame fuel ignited by spark plug and atomized gasoline and/or secondary fuel. TM 3-1040-206-10.
				Mounted in dummy 90-mm gun tube.
230	Not recommended.			
185	Not recommended.			
				Includes fuel and pressure containers located in tank turret; pressure containers charged with compressed air or nitrogen.[1]
Approx. 230	Not recommended.	3,000	325	Installed in the M113 armored personnel carrier only.[1] TM 3-1040-209-12 (when published).

★3.20. Characteristics of ABC–M3A3 Mechanical Smoke Generator

a. General.
(1) *Status:* Standard-A.
(2) *Weight:* Empty, 163 lb. Filled, 180 lb.
(3) *Dimensions:* Length, 42 in. Width, 18 in. Height, 23 in.
(4) *Engine:* Type: pulse jet. Description: single cycle, air cooled, 60 pulses per second. Starting method: magneto and hand-operated air pump.
(5) *Delay in smoke production after starting engine:* 30 seconds.

b. M4 Fog Oil Pump.
(1) *Description:* Air motor-oil pump combination; air motor operated by exhaust engine gases.
(2) *Capability:* 25 to 40 GPH.

c. Fog Oil Drum Operating Pressure. None.

d. Generator Mount.
(1) *¼-ton truck:* M12 mount.
(2) *¼-ton trailer:* M2 mount.

e. Fog Oil Drum Mount for ¼-ton Trailer: M3 mount.

f. Gasoline.
(1) *Tank capacity:* 3½ gal.
(2) *Octane rating:* 76 or higher.
(3) *Consumption rate:* 3 GPH.

g. Fog Oil Consumption Rate.
(1) *Minimum:* 25 GPH. [1]
(2) *Maximum:* 40 GPH.
(3) *Normal:* 40 GPH.

h. Temperature Limits for Use of Fog Oil.
(1) *SGF1:* NA.
(2) *SGF2:* Above 32° F.
(3) *75–25 mixture:* [2] 32° to 0° F.
(4) *60–40 mixture:* [3] 0° to −25° F.
(5) *40–60 mixture:* [4] −25° to −40° F.

[1] Operation at rate of 25 GPH should be limited to relatively short period to prevent damage to generator; usual minimum rate is 30 to 35 GPH.
[2] 75 parts SGF2 and 25 parts jet fuel (JP–4) or wax-free kerosene.
[3] 60 parts SGF2 and 40 parts jet fuel (JP–4) or wax-free kerosene.
[4] 40 parts SGF2 and 60 parts jet fuel (JP–4) or wax-free kerosene. ★

3.21. Characteristics of Airplane Smoke Tank, M10

Type (symbol)	Filling				Remarks
	Unit weight (lb per gal.)	Operating volume (gal.)[1]	Operating weight (lb)	Filled tank weight (lb)[2]	
CNB	9.50	30	285	353	Weight of empty M10 tank is 68 lb; maximum dimensions are 20½ in. in diameter, 14 in. high, and 84 in. long. Auxiliary equipment includes M10 set accessories, M10 insulating cover, M2A1 hand-driven pump, M3 filling line, M1 orifice, M2 hoisting beam, and M1 carrying stand.
CNC	10.88	30	326	394	
FS	16.00	30	480	548	
H	11.30	30	339	407	
HD	10.70	30	321	389	
MR [3]	8.80	30	264	332	

[1] Maximum volume of tank is 33 gal. 3-gal. void left for expansion of filling.
[2] When insulating cover is used, add approximately 40 lb.
[3] For training purposes.

manual applies; a suffix P attached to the final number indicates a repair parts list published separately from the maintenance instructions.

Example: TM 3-4240-204-15P

3—preparing technical service
4240—FSC class of equipment
204—numerical sequence (5th technical manual for TM 3-series within FSC class 4240)
15—echelons of maintenance (1–5)
P—repair parts list for same echelons of maintenance (1–5)

4.7. Assignment of Logistics Functions

The assignment of logistical responsibility to the technical services by the Department of the Army is accomplished by Army regulations of the 701-series. These AR's assign to the technical services, by FSC class, responsibility for performing each of the separate logistical functions (researeh and development, specifications and standardization, requirements and funds, purchasing and inspection, depot storage and issue, stock control and accountability, maintenance, and disposal). Normally a single technical service is assigned to perform all the logistical functions for an entire FSC class; however, the FSC class may be divided among several technical services; or, different technical services may be assigned separate logistical functions for the same FSC class. For example, the Ordnance Corps may be assigned to perform all the logistical functions for an entire FSC class except that the Chemical Corps may be assigned the logistics functions for specific items in the same FSC class. Also, the Chemical Corps may be assigned to perform the research and development function for an FSC class, and the Ordnance Corps may be assigned to perform the other logistical functions. Paragraph 4.3c list the primary FSC classes in which Chemical Corps items of supply are included.

4.8. Regulated and Command-Controlled Items

a. Regulated Items. Regulated items are items which are costly, are of a highly technical or hazardous nature, or are scarce from a national standpoint. An item on the regulated items list can be deleted only through action by the Department of the Army. The theater commander, through command channels, must exercise close supervision of issues to insure proper distribution in accordance with existing priorities. Requisitions for regulated items must be processed through command channels. The theater commander will determine at what command levels various items can be approved for issue. Chiefs of technical services must exercise close supervision of regulated items for which their service has supply responsibility to insure that distribution is accomplished in accordance with priorities established by the Department of the Army. Lists of regulated items for all technical services, which are applicable worldwide, are published in supply bulletins. SB 725–350 lists Chemical Corps regulated items.

b. Command-Controlled Items. In addition to regulated items, commanders at all echelons may control other items which are in short supply or are critical in nature. In so doing they normally publish controlled items lists or directives which require the same general procedures for obtaining such supplies or equipment as for regulated items.

Section II. REQUIREMENTS

4.9. Day of Supply

A day of supply is a unit or quantity of supplies adopted as a standard of measurement used in estimating the average daily expenditure of supplies for a given force under stated conditions. Day of supply is expressed as a factor—for example, pounds of supplies per man per day or tons of supplies per division per day. When a day of supply is used for planning purposes, the number of troops or the size of the force and the type of operations for which the day of supply is applicable must be considered. Obviously, the number of men to be supported, and whether the force will be conducting an amphibious or airborne landing, will affect the total tonnage of supplies required. Day of supply planning data by supply class (I, II, III, and so forth) and by technical service are contained in FM 101–10, part I. These data were compiled for specific theaters of operation and are based on previous combat experience and the latest information on supply requirements. See also paragraph 4.13.

4.10. Division Slice

In logistical planning, a preliminary estimate of the total size of a force is required to determine the final composition and the ultimate size of the force, since the required number of many service units, such as chemical decontamination and processing

units, bears a direct relationship to the size force. The division slice includes the strength of an average combat division plus proportionate shares of the total corps, army, communications zone, and zone of interior personnel who are required to support one division. The total number of personnel in a theater division slice is 43,250. The division slice for any given force is equal to the total strength of the force divided by the number of combat divisions in the force. For a more complete discussion of division slices and chemical troop composition of a division slice, see FM 101-10, part I.

4.11. Basic Load for Chemical Corps Nontoxic Ammunition

A basic load of ammunition is that quantity of ammunition authorized to be carried by individuals and on the vehicles of a unit. Normally a unit's basic load will be sufficient to sustain that unit until resupply can be effected. A suggested basis of issue of Chemical Corps nontoxic ammunition for use in the determination of basic loads is provided in SB 3-39.

4.12. Day of Supply Data for Chemical Corps Ammunition

Day of supply data for Chemical Corps nontoxic ammunition may be found in SB 38-26. No day of supply data are presently available for toxic-filled Ordnance Corps ammunition or toxic-filled Chemical Corps ammunition.

★4.13. Consumption of Chemical Class II, IV, and V Supplies

To aid in estimating the tonnage of supplies needed to sustain combat forces, experience data have been compiled, based on the consumption of supplies during World War II and the Korean Conflict. The tables below contain consumption data for Chemical class II and IV supplies. The table in *a* below also contains consumption data for chemical class V supplies. *These figures are based on consumption under nonchemical and nonbiological operations.* In the absence of accurate experience data, consumption figures should be adjusted upward by a factor of 3 for predicting consumption under chemical and biological operations. Seven percent of chemical supply tonnage may be considered to be repair parts.

a. Chemical Class II, IV, and V Consumption, Theater of Operations.

Theater and class of supply	Pounds per man per day	Tons per man per month	Conversion factor (short tons to measurement tons)[1]	Measurement tons per man per month
European:				
Class II and IV	.12	.002	2.3	.005
Class V	.11	.002	1.2	.002
Pacific Regions:				
Class II and IV	.44	.007	2.3	.016
Class V	.09	.001	1.2	.001
Far East:				
Class II and IV	.93	.14	2.3	.326
Class V	.11	.002	1.2	.002
Polar Regions:[2]				
Class II and IV	.12	.002	2.3	.005
Class V	.11	.002	1.2	.002

[1] Conversion factors are based on average cubage for one item. One measurement ton (mton) is 40 cubic feet.
[2] Estimated, based on arctic test operations. ★

★4.19. Planning Allowances for Selected Class II Chemical Items [1]

Item	Factor		Basis	Remarks
	Quantity	Unit		
Compressor, reciprocating, power-driven, 3½ CFM.	1	Ea	Per unit authorized flamethrower, portable.	WABTOC, CONARC, ARADCOM
	2	Ea	Per inf bn, mech inf bn, abn bn.	
	1	Ea	Per unit with authorized riot control agent disperser, portable, helicopter- or vehicle-mounted.	
Decontaminating apparatus, portable 1½-qt.	1	Ea	Per self-propelled tactical or combat vehicle, wheeled or tracked, in theater of operations.	WABTOC, CONARC, ARADCOM
Decontaminating apparatus, power-driven, truck-mounted.	1	Ea	Per spt co, U.S. Army Missile Comd.	
	3	Ea	Per mech div, maint bn.	
	3	Ea	Per armd div, maint bn.	
	3	Ea	Per inf div, maint bn.	
	3	Ea	Per abn div, maint bn.	
Detector kit, chemical agent:				
M18A1	1	Ea	Per unit hq of CmlC units only	WABTOC, CONARC, ARADCOM
M18A1	1	Ea	Per cml staff section of div or higher hq	WABTOC, CONARC, ARADCOM
M15A1A	1	Ea	Per platoon or similar size unit	WABTOC, CONARC, ARADCOM
M15A1A	1	Ea	Per co, bn, or similar size unit hq	WABTOC, CONARC, ARADCOM
Filter unit, gas-particulate, hospital, six-man.	1	Ea	Per 100-patient general or station hospital.	WABTOC, CONARC, ARADCOM
Filter unit, gas-particulate, tank, four-man.	2	Ea	Per 103A1, M48A1, M48A2, and M48A3 tanks.	WABTOC, CONARC, ARADCOM
	2	Ea	Per 105-mm, 155-mm howitzer, self-propelled.	WABTOC, CONARC, ARADCOM
	2	Ea	Per bridge launcher on M48A2 tank chassis.	WABTOC, CONARC, ARADCOM
	1	Ea	Per M113 APC with M10-8 flamethrower.	WABTOC, CONARC, ARADCOM
	1	Ea	Per carrier, personnel, full-tracked	WABTOC, CONARC, ARADCOM
Filter unit, gas-particulate, tank, five-man.	1	Ea	Per M60 tank.	
	1	Ea	Per M88 recovery vehicle.	
	1	Ea	Per bridge launcher, armd vehicle with M60 chassis (under development).	
	1	Ea	Per combat engr vehicle, full-tracked, T118.	
Flamethrower, mechanized, main-armament, APC mounted.	2	Ea	Per inf div, inf bn; armd div, mech inf bn; mech div, mech inf bn; abn div, inf bn; inf div, engr bn; mech div, engr bn; armd div, engr bn; engr bn.	WABTOC, CONARC
	1	Ea	Per engr co, mech bde, armd bde, inf bde.	WABTOC, CONARC
Flamethrower, portable	1	Ea	Per rifle platoon	WABTOC, CONARC
Heater, water, oil	1	Ea	Per U.S. Army Missile Comd.	
	1	Ea	Per three PDDA's authorized.	
Mask, protective, tank [2]	2	Ea	Per M113 APC with M10-8 flamethrower.	WABTOC, CONARC, ARADCOM
	2	Ea	Per bridge launcher on M48A2 tank chassis.	WABTOC, CONARC, ARADCOM
	2	Ea	Per M88 tank recovery vehicle	WABTOC, CONARC, ARADCOM
	2	Ea	Per combat engr vehicle, full-tracked, T118.	WABTOC, CONARC, ARADCOM
	2	Ea	Per bridge launcher on M60 tank chassis.	WABTOC, CONARC, ARADCOM
	4	Ea	Per M48A1, M48A2, and M48A3 tanks.	WABTOC, CONARC, ARADCOM
	4	Ea	Per M60 tank	WABTOC, CONARC, ARADCOM
Radioactive source set	1	Ea	Per inf, abn, armd, mech div.	

Item	Factor		Basis	Remarks
	Quantity	Unit		
Riot control agent disperser, helicopter- or vehicle-mounted.	5	Ea	Per div avn co.	
	5	Ea	Per avn GS co.	
	6	Ea	Per air mbl co.	
Riot control agent disperser, portable.	1	Ea	Per MP platoon. All MP units NOA except units organized under TOE 19-47E, TOE 19-237D, TOE 19-252D, TOE 19-256D, and TOE 19-500D can be auth more than one.	
	3	Ea	Per overseas bn NOA.	
	17	Ea	Per Eighth U.S. Army NOA.	
Sampling kit, chemical agent.	1	Ea	Per div cml section.	
	1	Ea	Per corps cml section.	
	1	Ea	Per army cml section.	
Service kit, portable flamethrower-riot control agent disperser.	2	Ea	Per inf div, maint bn; armd div and mech div, supply and trans bn; abn div, maint bn.	WABTOC, CONARC
	1	Ea	Per hq and hq co, spt bn, inf and mech bde	WABTOC, CONARC
	1	Ea	Per inf div, armd div, mech div engr bn	WABTOC, CONARC
	1	Ea	Per hq and hq co engr bn	WABTOC, CONARC
	1	Ea	Per engr co mech, inf, and armd bde	WABTOC, CONARC

[1] Does not include equipment used only by chemical units. These allowances are not to be construed as authority for current issue.
[2] The basis of issue for this item authorized this mask for those individuals assigned to a combat vehicle equipped with a filter unit and not otherwise authorized the M17 mask. ★

★4.20. Mobilization Planning Allowances for Nonexpendable Class IV Chemical Items [a]

Item	Factor		Basis
	Quantity	Unit	
Filter unit, gas-particulate, EMD or GED	[b] 50	Ea	Per theater division slice
			or
	[b] 200	Ea	Per theater corps slice.
Filter unit, gas-particulate, hospital, six-man	As required	Ea	Per Maxillo Facial Center or hospital specializing in treatment of head and neck wounds.
Mask, protective, aircraft	1	Ea	Per pilot and crewman of all Army fixed-wing and rotary-wing aircraft.
Mask, protective, headwound	1	Ea	Per 100 beds in sta hospital, COMMZ.
	2	Ea	Per med det, med disp; gen disp; holding sec, med holding co; hosp unit of field hosp; 100 beds in gen hosp, COMMZ.
	4	Ea	Per med elm of nonmed unit, clr plt, nondiv.
	8	Ea	Per clr plt
	10	Ea	Per evac hosp, 400 beds.
	10	Ea	Per hq elm of div med bn/co.
	12	Ea	Per mbl army surg hosp.

[a] These allowances are not to be construed as authority for current issue.
[b] CBR operations. ★

★4.21. End Item Densities for Combat Divisions

Rescinded★

★4.22. End Item Densities for Road Divisions

Equipment (full strength)	Division base				Inf Bn TOE 7-15E	Tank Bn [5] TOE 17-35E	Mech Inf Bn [6] TOE 7-45E	Airborne Inf Bn TOE 7-35E	Airborne Div Tank Bn TOE 17-15E
	Inf Div [1] TOE 7E	Armored Div [2] TOE 17E	Mech Div [3] TOE 37E	Airborne Div [4] TOE 57E					
Chemical									
Calibrator, radiac, AN/VDM-6	1	1	1	1					
Compressor, reciprocating, power-driven, 3½ CFM	3	3	3	4	2		2	2	
Decontaminating apparatus, portable, 1½-qt	2,152	2,208	2,204	1,272	117	173	171	116	160
Decontaminating apparatus, power-driven, truck-mounted	3	3	3	3					
Detector kit, chemical agent	1	1	1	10		3		3	4
Detector kit, chemical agent, VGH	188	192	192	89	24	10	23	12	1
Filter unit, gas-particulate, tank, four-man	144	330	330		24	40	87	3	49
Filter unit, gas-particulate, tank, five-man						50			
Flamethrower, portable					9		9	9	
Flamethrower, mechanized, main-armament [7]	2	2	2		2		2	2	
Goggles, industrial, ventilated, clear				9					
Mask, protective, tank	322	855	855			307	220	6	188
Radioactive source set	1	1	1	1					
Riot control agent disperser, portable	4	4	4	3	6		12		
Riot control agent disperser, helicopter- or vehicle-mounted	11	11	11	11					
Sampling kit, chemical agent	1	1	1	1				1	
Service kit, portable flamethrower—riot control agent disperser	1	1	1	3	2		2	4	
Service unit, flamethrower, truckmounted [7]	4	4	4	2					
Radiacs (Signal)									
Calibrator, radiac, TS-784/PD	4	7	4						
Charger, radiac detector, PP-1578A/PD	164	176	176	149	15	16	15	16	16
Radiacmeter, IM-93/UD	662	662	662	521	51	50	51	48	50
Radiacmeter, IM-174/PD	191	192	192	168	27	26	27	28	24
Radiac set, AN/PDR-27J	29	26	32	24		1		1	1
Radiac set, AN/PDR-60	1	1	1	1		1			

[1] Type infantry division consists of 8 infantry battalions, 2 tank battalions, and an infantry division base.
[2] Type armored division consists of 5 mechanized infantry battalions, 6 tank battalions, and an armored division base.
[3] Type mechanized division consists of 7 mechanized infantry battalions, 3 tank battalions, and a mechanized division base.
[4] Type airborne division consists of 9 airborne infantry battalions, 1 airborne division tank battalion, and an airborne division base.
[5] Equipment authorization is the same when organic to infantry division, armored division, or mechanized division.
[6] Equipment authorization is the same when organic to armored division or mechanized division.
[7] These items are being added to the appropriate TOE at the next revision.★

Section III. CLASS V BASIC LOAD FOR CHEMICAL UNITS

4.23. General

The tables below furnish, for planning purposes, Ordnance ammunition basic load data for chemical units. Paragraph 4.25 lists ammunition basic load data for chemical smoke generator units which are likely to become involved in direct combat with the enemy. Paragraph 4.24 is applicable to all other chemical TOE units and also to smoke generator units which are not likely to become involved in direct combat with enemy forces. The assignment of weapons to chemical units may be found in paragraph 2.8. The tables in paragraphs 4.24 and 4.25 do not include basic load data for Chemical Corps nontoxic ammunition. These data are published in SB 3-39.

4.24. Ammunition Supply Data—Chemical Units—Basic Load

Weapon	Rounds per weapon		Weight per round (lb)
	Secure area	Area of guerrilla activity	
Carbine, cal .30	60	90	0.036
Gun, mach, cal .50, Brg, hv barrel, flex	420	525	.390
Gun, mach, 7.62-mm, lt wt, general purpose	1,760	2,200	.080
Gun, submach, cal .45	60	90	.057
Launcher, rocket, 3.5-in	3	3	17.700
Pistol, auto, cal .45	21	21	.057
Rifle, auto-semiauto, 7.62-mm, selective, hv barrel	260	500	.072
Rifle, semiauto, 7.62-mm, lt barrel	100	160	.072
Rifle, U.S. cal .30	96	144	.095

★4.25. Ammunition Supply Data—Chemical Smoke Units—Basic Load

Unit and type munition	Rd per wpn	Wt per rd (lb)	Total wpn	Total rd	Carried on individual		Carried on vehicle		Bulk loaded		Total weight (lb)
					Rd per wpn	Total wt (lb)	Rd per wpn	Total wt (lb)	Rd per wpn	Total wt (lb)	
HQ & HQ DET, CML SMOKE GENR BN (TOE 3-266E)											
Pistol, auto, cal .45	21	0.057	2	42	21	2.39					2.39
Rifle, semiauto, 7.62-mm, lt barrel	120	0.072	20	2,400	60	86.40	60	86.40			172.8
											175.19 = 0.09 tons
CML SMOKE GENR CO (TOE 3-267E)											
Gun, mach, cal .50, Brg, hv barrel, flex	530	0.390	3	1,590			530	620.10			620.10
Gun, mach, 7.62-mm, lt wt, general purpose	2,000	0.080	5	10,000			2,000	800			800.00
Launcher, rocket, 3.5-in	6	17.700	4	24			6	424.80			424.80
Rifle, semiauto, 7.62-mm, lt barrel	120	0.072	141	16,920	60	609.12	60	609.12			1,218.24
Generator, smoke, mechanical, pulse-jet.[a]	[b] 3	461.0	48	[b] 144			2	44,256.0	1	22,128.0	66,384.0
	[c] 2	42.000	48	[c] 96			1	2,016.0	1	2,016.0	4,032.0
											73,479.14 = 36.23 tons

[a] A single mechanical smoke generator operating at maximum capacity consumes approximately 1,200 gallons of fog oil per 24-hours day.
[b] Round is 55-gallon drum of fog oil.
[c] Round is 5-gallon can of 80-octane gas. TA 10-100 authorized three 5-gallon cans per smoke generator. ★

★4.26. Breathing Apparatus, Protective Masks, and Respirators

Type of mask	Status	Logistical data				Use
		Units per container	Weight (packaged) (lb)	Volume of package (cu ft)	Sizes [a]	
Breathing apparatus, compressed air, M15.	Std C	1/box	29	1.0	(M)	Supplies respirable air to handlers of liquid guided missile fuels and oxidizers; also used in any atmosphere which is deficient in oxygen.
Breathing apparatus, compressed air, ABC–M15A1.	Std A	1/box	31	1.5	(M)	Same as for M15. M15A1 has an added alarm, a safety valve, and a mask winterizing kit.
Breathing apparatus, oxygen generating, M20.	Std A	1/case w/3 canisters.	40	2.2	(M)	Is used where there is a deficiency of oxygen or a high concentration of toxic vapors in the air.
Mask, antiflash, rocket launcher, M19.	Std B	100/box	100	[b] 2.2	NA	Protects face and eyes of individual firing 3.5-in. rocket launcher.
Mask, gas, acid and organic vapors, M10.	Std A	6/box	74	4.4	(M)	Special-purpose mask. Protects against toxic acids and organic vapors with the exception of ammonia fumes and carbon monoxide.
Mask, gas, all-purpose, M11A1	Std A	6/box	74	4.4	(M)	Protects against all poisonous gases, smoke, and fumes encountered in industry or in handling chemical agents.
Mask, gas, ammonia, M12	Std A	6/box	74	4.4	(M)	Protects against ammonia gas only.
Mask, gas, dog, M6–12–8	Std A	12/box	51	3.9	NA	Protects dogs against CBR agents.
Mask, gas, rocket propellant, ABC–M21.	Std A	6/box	96	4.1	(S) (M) (L)	Protects personnel handling liquid rocket propellant fuels against low concentration of vapors from the fuels.
Mask, protective, aircraft, M24	Std A	10/box	72	5.2	(S) (M) (L)	Protects aircraft pilots and crewmen against CBR agents.
Mask, protective, civilian, M22	Std A (Civil Defense).	30/box	33	3.3	1, 2, 3, 4, 5, 6,	Lightweight mask to protect civilians against CBR agents; standard civil defense mask; mask will fit any civilian except children under 4 years.
Mask, protective, field, M9 and M9A1.	Std B	6/box	56	3.3	(S) (M) (L) [c]	Protects face, eyes, and respiratory tract against CBR agents; only difference between models is difference in carriers.
Mask, protective, field, ABC–M17	Std A	10/box	58 44	4.1 3.3	(S) (M) (L) [d]	Protects face, eyes, and respiratory tract against CBR agents.
Mask, protective, headwound, ABC–M18.	Std A	10/box	40	2.7	(U)	Protects face and respiratory tract of patients with head wounds against CBR agents during evacuation.

Mask, protective, non-combat, M16	Std A (Civil Defense).	12/box	39	3.1	3, 4, 5, 6	Protects civil defense workers against CBR agents; sizes do not include children's masks.
Mask, protective, tank, M14	Std C	6/box	60	2.6	(M)	Is used with 3-man M8A2 and 4-man M8A3 filter units for defense against CBR agents.
Mask, protective, tank, ABC–M-14A1.	Std B	6/box	60	2.6	(S) (M) (L) [e]	Performance is same as for M14; differences between models are discussed in appropriate TM's.
Mask, protective, tank, ABC–M-14A2.	Std A	10/box	71	5.1	(S) (M) (L) [e]	Performance is same as for ABC–M14A1; differences are improved nosecup to reduce fogging; provisions for attachment of eyelens inserts; special harness for canister to facilitate use without carrier.
Mask, protective, tank, M25	Std B					Same as above.
Mask, protective, tank, M25A2	Std A					Performance is same as for ABC–M14A2, except for use in vehicles with AN/VRC–12 FM radio set.
Respirator, air filtering, dust, ABC–M4.	Std A	90/box	29	1.6	NA	Protects against nuisance dust; employs a pad type filter and has no outlet valve.
Respirator, air filtering, paint spray, M5.	Std B	12/box	70	4.1	NA	Protects against organic vapors, paint lacquer, and enamel mists.
Respirator, air filtering, paint spray, commercial M6.	Std A	12/box	Commercial item, weight and volume unspecified.			Protects against organic vapors, paint lacquer, and enamel mists.

[a] Sizes are small (S), medium (M), large (L), and universal (U).
[b] Estimated.
[c] Tariff size: 26 percent small, 68 percent medium, 6 percent large. 92 percent left-cheek canisters, 8 percent right-cheek canisters.
[d] Tariff size: 11 percent small, 85 percent medium, 4 percent large.
[e] Tariff size: 26 percent small, 68 percent medium, 6 percent large. ★

★4.27. Replacement of Protective Mask Canister and Filter Elements

a. To determine when to replace the canister of a field protective mask during CBR operations, credit the life of each canister with 100 units; subtract the appropriate number of units for each type of agent attack listed below; and replace the canister when the 100 units have been exhausted.

b. To determine when to replace the filter elements of an M17 protective mask during CBR operations, credit the total life of the filter elements with 50 units; subtract the appropriate number of units for each type of agent attack listed below; and replace the filter elements when the 50 units have been exhausted.

Type of agent attack	*Units to be subtracted per attack*
Ground-delivered nerve agent	½
Air-delivered nerve agent	1
Blister agent	1
CK (30-sec to 2-min surprise attack)	10
All other agents, including unidentified ones	6

Units above are applicable for 30-second to 2-minute attacks. For exposure greater than 2 minutes, apply the following formula:

$$\frac{\text{Length of attack (minutes)} \times \text{number of units from above}}{2} = \text{Number of units to subtract.}$$

If exposed to heavy attacks of CK for 15 minutes, the canister or filter elements should be replaced after each exposure. For exposure to mustard, use the following formula:

$$\text{Hours of exposure (or fraction thereof)} \times 1 = \text{Number of units to subtract.}$$★

4.28. Protective Clothing

There are two general types of protective clothing, permeable and impermeable. Permeable protective clothing is also known as impregnated clothing. Protective clothing is a logistical responsibility of the Quartermaster Corps. (Exception is supplied-air impermeable suits which are a Chemical Corps responsibility.) The Chemical Corps provides technical assistance to the Quartermaster Corps in the development of protective clothing. Impregnation of permeable clothing is a responsibility of the Chemical Corps and is accomplished by the chemical processing company.

★*a. Permeable Protective Clothing.* Permeable clothing is worn by combat troops and service support troops during warfare under CBR conditions. Stocks of complete sets of permeable protective clothing will not be maintained in the hands of troops, except as required for training. Allowances of permeable (impregnated) clothing are prescribed in TA 50–901 (PEACE), TA 50–902 (MOB), and TA 20–11. Allowances vary, depending on the climatic zone where the clothing will be worn (see AR 700–62). Items of permeable clothing are:

(1) Drawers, man's, cotton knit, ankle length.
(2) Undershirt, man's, cotton knit, full length sleeve.
(3) Shirt, man's, cotton sateen.
(4) Trousers, man's, cotton sateen.
(5) Gloves, cloth, work type, man's, cotton, knit cuff.
(6) Gloves, shell, leather.
(7) Hood, gas mask, toxicological agents, protective.
(8) Socks, man's, wool, black, w/cushion sole.
(9) Boots, combat.
(10) Flap, vesicant gas protective, man's shirt-jacket.
(11) Flap, vesicant gas protective, man's trousers.
(12) Coat, vesicant gas protective (cotton sheeting).
(13) Trousers, vesicant gas protective (cotton sheeting).

Each item of permeable clothing must be requisitioned separately. Stock numbers and complete nomenclatures of above items may be found in appropriate Quartermaster supply manuals.★

★*b. Impermeable Clothing.* Impermeable clothing is intended primarily for the protection of military personnel engaged in extremely hazardous decontamination work or in special operations involving danger from spillage or splashes in the handling of liquid chemical agents. Impermeable clothing is made of butyl-rubber-coated materials which resist penetration of liquid chemical agents and provide complete protection against biological agents, as well as protection against physical contact with radioactive dust. Allowances of impermeable clothing are contained in TA 50–901 (PEACE), TA 50–902 (MOB), and TA 20–11. The complete impermeable outfit consists of an inner layer of permeable clothing (see *a* above) and an outer layer or shell of imperme-

able clothing. Items of impermeable clothing and equipment are:

(1) Coveralls, toxicological agents, protective.
(2) Hood, gas mask, toxicological agents, protective.
(3) Cover, boot, toxicological agents, protective.
(4) Gloves, toxicological agents, protective synthetic rubber and nylon film.
(5) Boot, knee, man's, rubber; boot, insulated; or boot, combat.
(6) Suit, cooling, toxicological agents, protective coveralls.
(7) Cover, cooling, toxicological agents, protective gas mask hood.
(8) Apron, toxicological agents, protective.

Items (6), (7), and (8) above are impermeable clothing accessories. Each item of impermeable clothing must be requisitioned separately. Stock numbers, complete nomenclature, and other data needed for requisitioning items of impermeable clothing may be found in the appropriate Quartermaster supply manual.★

e. Impermeable Clothing Wearing Time. The table below shows maximum wearing time recommended for personnel engaged in moderate physical activity while wearing impermeable clothing without cooling suit and hood cover.

Temperature (° F)	Wearing time (hr)
Above 90	¼
85 to 90	½
80 to 85	1
70 to 80	1½
60 to 70	2
50 to 60	3
30 to 50	5
Below 30	8

d. Reference. Stockage and issue policy, as well as guidance for determining items and quantities of protective equipment, may be found in AR 700–62.

★4.29. Characteristics of Gas-Particulate Filter Units

Type	Status	Net weight (lb)	Packaging data					Purified air delivery (CFM)	Means of operation
			Weight (lb)	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)		
ABC–M6 GED	Std B	400	705	34	24	39	37.1	300	1½ HP gasoline engine, for outside installation; uses two M10 gas filters and two M9 particulate filters.
ABC–M6 EMD	Std B	400	705	34	24	39	37.1	300	1 HP electric motor, 110 volt, 60 cycle 746 watts, for outside installation; uses two M10 gas filters and two M9 particulate filters.
ABC–M6A1 EMD	Std A	[a] 400	[a] 705	[a] 34	[a] 24	[a] 39	[a] 37.1	[a] 300	Same as above.
ABC–M6A1 GED	Std A	[a] 400	[a] 705	[a] 34	[a] 24	[a] 39	[a] 37.1	[a] 300	Same as above.
M7, hospital, six-man	Std B	[a] 69	138	39	14½	17½	5.7	12	24 volt DC or 115 volt, 60 cycle, AC, for inside installation.
ABC–M7A1, hospital, six-man.	Std A	[a] 69	138	39	14½	17½	5.7	12	24 volt DC or 115 volt, 60 cycle AC, for outside or inside installations; uses M13 particulate filter and M12A1 gas filter.
ABC–M8A2, tank, three-man.	Std B	50	53	15⅓	14⅓	14⅓	1.6	12	24 volt AC or DC, for outside or inside installation; uses M2A1 gas filter and M13 particulate filter.
ABC–M8A3, tank, four-man.	Std A	----------	52	----------	----------	----------	1.8	12	Same as M8A2 except permits four-man installation.
M9 GED	Std A [b]	600	830	81	30	40	57	600	1½ HP gasoline engine, for outside installation; uses M14 gas-particulate filter.
M9 EMD	Std C	800	1,200	103	30	40	71.5	600	1 HP electric motor, 230 volt, 60 cycle, 3 phase AC, for outside installation; uses M14 gas-particulate filter.
M9A1 EMD	Std A	800	1,200	88	33	45	75	600	1 HP electric motor, 230 volt, 60 cycle, 3 phase AC, for inside or outside installation; uses M14 gas-particulate filter.
M10 GED	Std A	1,000	1,840	136	30	40	132	1,200	2½ HP gasoline engine, for outside installation; uses M15 gas-particulate filter.
M10A1 EMD	Std A	1,200	1,840	116	33	45	93.9	1,200	2 HP electric motor, 230 volt, 60 cycle, 3 phase AC, for inside or outside installation; uses M15 gas-particulate filter.

See footnotes at end of paragraph.

Type	Status	Net weight (lb)	Packaging data					Purified air delivery (CFM)	Means of operation
			Weight (lb)	Length (in.)	Width (in.)	Height (in.)	Cubage (cu ft)		
ABC–M13, tank, five-man.	Std B		100				4.0	20	24 volt AC or DC; supplements requirements for M8A2 filter unit; uses one M19 particulate filter and two M18 gas filters.
ABC–M13A1, tank, five-man.	Std A								Same as above.
M11 GED	Std A	1,500	2,400	138	53	60	253.9	2,500	5.6 HP gasoline engine, for outside installation; uses M16 gas-particulate filter.
M11 EMD	Std A	1,700	2,950	163	40	52	190.6	2,500	5 HP electric motor, 230 volt, 3 phase AC, for outside installation; uses M16 gas-particulate filter.
M12 GED	Std A	2,600	4,000	158	53	60	290.7	5,000	10 HP gasoline engine for outside installation; uses M17 gas-particulate filter.
M12 EMD	Std A	2,800	4,165	158	52	60	285.2	5,000	7½ HP electric motor, 230 volt, 60 cycle, 3 phase AC, for outside installation; uses M17 gas-particulate filter.

[a] Approximate.
[b] Standard A, Navy.★

★4.30. Miscellaneous Protective Equipment

Item	Status	Logistical data			Use
		Units per container	Weight (packaged) (lb)	Volume of package (cu ft)	
Bag, waterproofing, protective mask, M1.	Std A	250	50	1.5	Protects M9A1 mask immediately prior to amphibious operations.
Hood, field protective mask, M6 [1]	Std A	1	----------	--------	Provides protection to the head and neck against vapors, aerosols, and droplets while wearing the ABC-M17 field protective mask.
Hood, field protective mask, M5 [2]	Std A	1	----------	--------	Provides protection to the head and neck against vapors, aerosols, and droplets while wearing the tank protective mask.
Leather dressing, vesicant gas resistant.[3]	Std A	48	15 (4-oz cans)	.43	Retards passage of blister agents through leather.
Protection and treatment set, chemical agents, M5A3.	Std A	70	50	1.4	*Contents of set:* 3 tubes M5 protective ointment. 1 atropine syrette.
Vesicant agent protective ointment, M5.	Std A	576 144	75 15	1.8 0.3	Decontaminant for blister agent.
Winterizing kit, protective mask, M1.	Std A	72	79½	3.2	Protects M9A1 mask in extreme cold.
Winterizing kit, protective mask, M3.	Std A	100	----------	--------	Protects mask, protective, tank, in extreme cold.
Winterizing kit, protective mask, M4.	Std A	100	----------	--------	Protects ABC-M17 field protective mask in extreme cold.

[1] One hood per ABC-M17 field protective mask.
[2] One hood per ABC-M14A2 tank protective mask.
[3] Item supplied by Corps of Engineers. ★

4.31. Detection and Identification Equipment

Item	Status	Logistical data			Use
		Units per container	Weight (packaged) (lb)	Volume of package (cu ft)	
Alarm, G-agent, automatic, fixed installation, M5.	Std A	4 boxes	Box 1— 90 2—1,030 3— 250 4— 480	11.0	Provides an automatic alarm system for detecting G-agents.
Analyzing kit, chemical agent, M10A1.	Std A	1/box	45	2.1	Identifies vapors of the following agents: G-series, CK, AC, CG, L, ED, H, HN, CN, BBC, and PS.
Calculator set, nuclear, M28 (w/calculator, radiac, ABC-M1, and calculator, nuclear yield M4).	Std A	100 sets/box	20	.87	Makes quick and accurate calculations of residual radiation in radioactive fallout areas.
Crayon, vesicant detector, M7	Std B	3/can 128 cans/box.	35	.6	Detects liquid blister agents.
Crayon, vesicant detector, M7A1	Std A	3/can 128 cans/box.	35	.6	Same as for M7 crayon.
Detector kit, chemical agent, M9A2.	Std B	8/box	50	2.1	Detects G-agents, CK, AC, CG, L, ED, H, HN; uses C9A2 refill kit.
Detector kit, chemical agent, VGH, AN-M15A1A.	Std A	30/box	48	2.3	Detects V-agents, G-agents, H, CK, and CX; uses C15R1 refill kit.
Detector kit, chemical agent, M18	Std B	8/box	43	1.7	Detects vapors of AC, CG, CK, ED, G-agents, H, HN, and L.
Detector kit, chemical agent, ABC-M18A1.	Std A	10/carton	30	1.7	Same as for M18 except M18A1 may be used also to detect V-agents and CX.
Food testing and screening kit, chemical agents, ABC-M3.	Std A	24/box	45	.8	Detects contamination of food or food packages by chemical agents.
Paper, liquid vesicant detector, M6.	Std B	100 books/box	45	1.0	Detects presence of liquid blister agents and liquid G-agents.
Paper, liquid vesicant detector, M6A1.	Std A	100 books/box	45	1.0	Same as for M6 paper.
Sampling kit, chemical agent, M12.	Std A	1/box	43	2.3	Used in collecting samples of suspected persistent liquid or solid chemical agents from soil, vegetation, or food surfaces and preparing them for shipment to laboratories.
Water testing kit, chemical agents, AN-M2.	Std A	24/box	50	1.0	Detects contamination of unchlorinated water by chemical agent.
Water testing kit, poisons, M4A1	Std A	1/box	45	2.3	The M4A1 poisons water-testing kit is used in conjunction with a water-testing and screening kit to measure the concentration of previously identified chemical agents in water; to determine the feasibility of treating the water; to determine the quality of chemicals needed for treatment; and to test whether the treatment has been successful.

Section V. CLASS III SMOKE AGENTS

4.32. Fog Oils

Fog oils SGF1 and SGF2 are class III smoke agents which are stored and issued by the Quartermaster Corps. SGF2 fog oil is used with the ABC–M3A3 smoke generator.

Nomenclature	QMC stock No.	Unit	Shipping container			
			Number of units	Type	Cubage (cu ft)	Gross weight (lb)
Oil, fog, SGF1 [a]	9150–261–7897	Gal	53	55-gal. drum (16-gage).	11.2	468
Oil, fog, SGF1 [a]	9150–261–7898	Gal	53	55-gal. drum (18-gage).	11.2	455
Oil, fog, SGF2	9150–261–7894	Gal	53	55-gal. drum (16-gage).	11.2	461
Oil, fog, SGF2	9150–261–7895	Gal	53	55-gal. drum (18-gage).	11.2	448

[a] Formerly used with M3A1 and M3A2 smoke generators which are obsolete.

Section VI. WATER SUPPLY

4.33. Water Requirements for Operations of Chemical Units

Water supply requirements for operations of chemical units under temperate climatic conditions are shown below. In hot climates, maximum requirements may exceed the given values by 15 to 100 percent.

Water consumer	Daily water consumption (gal)	Remarks
Motor vehicle	⅛ to ½ (in level or rolling terrain).	Consumption varies with size of vehicle.
Motor vehicle	¼ to 1 (in mountainous terrain).	Consumption varies with size of vehicle.
Clothing impregnating plant	4,400	Includes 400 gal. for washing and cleaning purposes; 5 gal. distilled water also required daily for plant laboratory.
Power-driven, truck-mounted, 400-gal. decontaminating apparatus.	4,000	For decontamination purposes; apparatus normally filled from natural source.
Power-driven, truck-mounted, 400-gal. decontaminating apparatus.	4,000	For bathing purposes; apparatus normally filled from natural source.
Power-driven, trailer-mounted, 200-gal. decontaminating apapparatus.	2,000	For decontamination purposes; apparatus normally filled from natural source.
Mobile laboratory, M3	215	Includes 15 gal. distilled water required daily.
Laboratory, M2 (theater)	325	Includes 25 gal. distilled water required daily.

★4.34. Water Distribution and Storage Equipment of Chemical Units

Item	Capacity	No. per using unit full str (reduced str)	Using unit (TOE)	No. per using unit full str (reduced str)	Using unit (TOE)	No. per using unit full str (reduced str)	Using unit (TOE)
Bag, water, sterilizing	36 gal	8	3–7E	1	3–67D	1	3–147E
		1	3–32E	1	3–77E	1	3–217E
		1	3–36E	1	3–97E	1	3–267E
		1	3–47E	1	3–117E		
Can, water*	5 gal	16	3–7E	8	3–217E	4 (3)	Team EA
		10	3–32E	4	3–266E	10 (6)	Team EB
		6	3–36E	28	3–267E	4 (2)	Team FA
		7	3–47E	1 (1)	Team AA	8 (8)	Team FB
		10	3–67D	1 (1)	Team AB	2 (2)	Team GA
		19	3–77E	1 (1)	Team AC	4 (4)	Team HA
		10	3–97E	4 (2)	Team BA	2 (1)	Team IA
		5	3–117E	7 (5)	Team BB	1 (1)	Team JA
		9	3–147E				
Decontaminating apparatus, power-driven, truck-mounted.	400 gal	5	3–147E	4 (1)	Team FA	6 (6)	Team FB
		12	3–217E				
Heater, immersion type, for corrugated can.		12	3–7E	6	3–77E	8	3–217E
		6	3–47E	4	3–117E	6	3–267E
		6	3–67E	8	3–147E		
Heater, water, immersion type, gasoline-operated.		1	3–7E	1	3–217E	1 (1)	Team AB
		1	3–67D	1	3–147E	1 (1)	Team AC
		1	3–117E	3	3–267E		
Heater, water, oil		5	3–147E	6	3–217E		
Hose, cotton, rubber-lined, 1½ in. by 25 ft (fire).		4	3–77E	2 (2)	Team FA	4 (4)	Team FB
		6	3–217E				
Hose, suction, water, 2 in. by 10 ft.		10	3–77E				
Hose, suction, water, 2 in. by 20 ft.		15	3–217E				
Hose suction, water, 1½ in. by 10 ft.		5 (5)	Team FA	10 (10)	Team FB	10	Team FC
Hose, water, ¾ in. by 50 ft		6	3–77E				
Pump, centrifugal, gasoline-driven.	55 GPM	2	3–77E	3	3–217E		
Pump, centrifugal, gasoline-driven.	166 GPM	1 (1)	Team FA	2 (2)	Team FB	1	3–147E
Tank, fabric, 3,000-gal	3,000 gal	2	3–77E	3	3–217E	2 (2)	Team FB
		1	3–147E	1 (1)	Team FA		
Trailer, 1½-ton, water tank, 2-wheel.	400 gal	1	3–7E	1	3–117E	3	3–267E
		1	3–47E	1	3–147E	1 (1)	Team AB
		1	3–67D	1	3–217E	1 (1)	Team AC
Water purification equipment, set No. 2.	900 GPH	1	3–97E				

*Authorized by TA 10–100.★

★*b. Recommended Decontaminants for Individual Chemical Agents on Materiel.* See part two of TM 3-220 for further information.★

Chemical agents	Decontaminants [1]	Remarks
G-agents (GA, GB, GD)	Slurry, hot soapy water, alkali solution,[2] or DS2.	STB and GA produce toxic vapors; in confined areas steam and ammonia should be used.
V-agents	DS2, slurry, DANC solution M5 protective ointment, or 5-percent sodium hypochlorite solution.	Liquid V-agents do not evaporate rapidly or freeze at normal freezing temperatures. Absorbed, V-agents remain toxic for some time. (See TC 3-10 for further information.)
Mustards (H, HD, HN, HQ, HT)	STB, slurry, DANC solution, DS2, or M5 protective ointment.	Dry STB on liquid mustard produces flame and toxic vapors. In sealed container, stable up to 10 years.
Lewisite (L), mustard-lewisite mixture (HL), phenyldichloroarsine (PD), ethyldichloroarsine (ED), methyldichloroarsine (MD).	STB, slurry, DANC solution, DS2, water, or caustic soda.	Decontamination products are toxic, fairly stable, nonvolatile, and insoluble in water. Alkali solutions [2] destroy vesicant properties.
Phosgene oxime (CX)	Large amounts of water or DS2	Liquid above 39°F. Readily soluble in water.
Phosgene (CG)	Water followed by alkali solution [2] or DS2.	CG liquid below 47°F.
Cyanogen chloride (CK), hydrocyanic acid (AC).	Sodium hydroxide solution or DS2	CK liquid below 55°F. AC liquid below 77°F.
Adamsite (DM)	Slurry or DS2	Aeration is sufficient in the field.
Diphenylchloroarsine (DA), diphenylcyanoarsine (DC).	Alkali solution [2] or DS2	Aeration is sufficient in the field.
CS	Water or 5-percent sodium bisulfite solution.	See TC 3-9 for further information.
Chloroacetophenone (CN), CN solution (CNB, CNC, CNS [3]).	Hot sodium carbonate solution, hot sodium hydroxide, or hot soapy water.	Aeration is sufficient for vapors.
White phosphorus (WP) or plasticized white phosphorus (PWP).	Water or copper sulfate solution	Water extinguishes burning WP; copper sulfate prevents further burning.
Sulfur trioxide-chlorosulfonic acid (FS)	Alkali solution,[2] water followed by alkali solution,[2] or hot soapy water.	Corrosive to metals when moist; acidic, destroys nylon and paint.
Titanium tetrachloride (FM)	Water or alkali solution [2]	Corrosive to metals.
HC mixture (HC)	Water or alkali solution [2]	No decontamination required for vapor. High concentrations toxic.

[1] Decontaminants are listed for checimal agents in liquid or solid state. In addition to decontaminants listed, aeration is effective for most chemical agents (vapors and light contamination) except V-agents. Screening smokes generally require no decontamination except aeration.

[2] Ten-percent solution of caustic soda, washing soda, baking soda, or household ammonia; 5-percent solutions are recommended for fabrics to include canvas and leather (par. 5.3c).

[3] In closed spaces, sodium sulfite is used for CNS.

★*c. Decontamination of Surfaces and Materials Contaminated with Toxic Chemical Agents.* The table contains methods of decontamination of various surfaces contaminated with toxic chemical agents. This table should be used with care as decontamination methods are dependent on many factors, especially the weather and the type of toxic chemical agent. TM 3-220 should be consulted for additional information.

Contaminated surface or object	Recommended decontamination method	Second or third echelon method	Alternate decontamination method
Asphalt:			
Roads	Weather. Flush with water. Cover with earth.	Spray with slurry from PDDA. Cover with dry mix.	Resurface.
Roofs	Weather. Flush with water. Cover with earth.	Spray with slurry from PDDA. Cover with dry mix.	Resurface.
Brick and Stone:			
Roads	Weather. Wash with hot soapy water.	Spray with slurry from PDDA. Cover with dry mix.	Resurface.
Buildings	Weather. Wash with hot soapy water.	Cover with slurry paste. Use STB on ground around buildings.	Spray with slurry from PDDA. Renew as necessary.
Canvas:			
Tarpaulins, tentage covers, mask carriers, cartridge belts.	Aerate (except V-agents). Immerse in boiling soapy water for 1 hour.	Use 5 percent solution of sodium hypochlorite (household bleach) for V-agents. Use 5 percent solution of washing soda.	Launder by standard methods. Use DANC or DS2. Use slurry.
Concrete:			
Roads	Weather. Flush with water. Cover with earth.	Spray with slurry from PDDA. Cover with dry mix.	Resurface.
Buildings, pillboxes, gun emplacements, etc.	Weather. Wash with hot soapy water. Cover with earth.	Spray with slurry from PDDA. Apply dry mix.	Resurface or refinish.
Earth:			
Roads, gun emplacements, bivouac areas, etc.	Weather. Burn vegetation. Cover pathways with earth.	Spray with slurry from PDDA. Use dry mix on small areas.	Remove top layer of surface with earth moving equipment.
Leather:			
Boots, gloves, etc.	Aerate. Scrub with hot soapy water.	Immerse in hot soapy water for 4 hours. Use sodium hypochlorite for V-agents, sodium carbonate for G-agents.	Burn or bury article. Treat with DS2 on both sides. Treat with DANC on both sides.
Fabrics:			
Cotton (coveralls, shirts, trousers, etc).	Aerate except for V-agents. Boil in hot soapy or alkaline water for 1 hour.	Use 5 percent sodium hypochlorite for V-agents, sodium carbonate for G-agents. Launder or dry clean.	Rub M5 ointment into small areas. Use DS2 on cotton items only.
Wool	Aerate except for V-agents. Immerse in warm soapy water for 1 hour; dry slowly.	Solvent extraction or dry cleaning.	
Glass:			
Windows	Aerate; weather. Wash with hot soapy water or organic solvent.	Use 5 percent solution of sodium hypochlorite for V-agents. Spray with DS2 or DANC.	Blot off surface.
Lenses	Aerate; weather. Wash with clear water, hot soapy water, or organic solvent.	Spray with DS2 or DANC solution.	Blot off surface.

Contaminated surface or object	Recommended decontamination method	Second or third echelon method	Alternate decontamination method
Grass and vegetation	Burn	Spray with slurry from PDDA	Clear paths through area by use of explosives. Explode drums of STB over the area.
Metals (unpainted):			
Machinery	Aerate; weather. Use DS2.	Wash with hot soapy water or organic solvent. Use DANC.	Steam clean.
Mess gear, etc	Immerse in boiling soapy water for 1 hour. Rinse.	Spray with DS2, DANC Wash with hot soapy water.	Weather; aerate.
Ammunition	Fire the ammunition. Weather. Use DS2. Wash with organic solvent.	Wash with cool soapy water	Use DANC.
Metals (painted):			
Vehicles, weapons, equipment.	Weather. Spray with DS2. Wash with hot soapy water.	Use DS2 or DANC	Steam clean.
Plastics (opaque):			
Insulation, telephones.	Weather. Spray with DS2. Wash with hot soapy water.	Wipe with organic solvent. Use DANC.	Destroy if agent damages surface.
Plastics (transparent):			
Eyepieces, airplane canopies.	Weather. Spray with DS2. Wash with hot soapy water.	Wipe with an organic solvent	Use DANC.
Rubber (impermeable):			
Aprons, suits, etc	Wash with hot soapy water. Immerse in hot soapy water, just below boiling point.	Spray with slurry or alkali solution from PDDA.	Weather. Aerate.
Rubber (natural or synthetic):			
Gloves and boots	Immerse in hot soapy water for 2 to 8 hours. Spray with DS2.	Immerse in slurry solution for 4 hours. Rinse off.	Apply M5 ointment. Aerate.
Mask facepiece	Immerse in hot soapy water. Do not boil more than four times a year.	Wash in boiling water not more than four times a year. Spray with DS2.	Apply M5 protective ointment to both sides.
Tires, hoses, etc	Weather. Spray with DS2. Immerse in hot soapy water.	Apply thick slurry. Allow to remain for at least 30 minutes.	If agent has seriously damaged surface, burn or bury item.
Sand (beaches, deserts, etc).	Weather. Flush with water.	Spread STB or slurry over surface.	Scrape off top 2 or 3 inches of soil. Cover paths with roofing paper.
Undergrowth and tall grass.	Weather. Burn.	Spray with slurry from PDDA	Explode drums of STB. Clear paths with detonating cord, etc.
Wood:			
Buildings, vehicle bodies.	Weather. Scrub with hot soapy water.	Spray with slurry from PDDA. Repeat as necessary.	Apply slurry by swabs, brooms, etc.
Boxes, crates, etc	Weather. Burn. Scrub with hot soapy water.	Spray with slurry from PDDA. Repeat as necessary.	Dip in slurry mixture.★

d. Decontamination Process Time Factors. Time factors for chemical decontamination processes are given below. Decontamination coverage in square meters is also listed.

Time Factors for Decontamination of Persistent Chemical Agents

Means	Filling and mixing time (minutes)	Discharge time (minutes)	Coverage (square meters)
Slurry with 400-gal. power-driven decontaminating apparatus.	40 to 45 (2 men adding bleach)	16, continuous spray (1 hose—13 GPM; 2 hoses—25 GPM).	1,300 (smooth surface); 650 (short grass); 400 to 433 (tall grass and brush).
Hot water and soap or detergent cleansing solution with 400-gal. power-driven decontaminating apparatus.	25 (2 heaters), 40 (1 heater)	Same as for slurry if continuous; 35 to 45, scrubbing and cutting rinse.	100 (metal surface).
Dry mix	5 to 10 (2 men mixing 50 lb of bleach).	45 to 60	50 per hour per man.[1]
Bleach (unmixed)	2 (50 lb)	30 to 45	125 per hour per man.[1]
DANC (3-gal. can)	10 (DANC solution or hot, soapy water).	10	50, or 1 cargo truck (3 applications).
DS2	2 (no mixing required)		15

[1] Divide by 2 for gravel; divide by 3 for tall grass and brush.

e. Storage Data for Decontaminants. Storage data on several decontaminants for chemical agents are shown below. Decontaminants not listed are adequately stable in storage.

Decontaminant	Storage characteristics	Surveillance requirements	
Acetylene tetrachloride	Stable; attacks metals in the presence of moisture.	*Mean shade temperature in hottest months*	*Frequency of inspections*
		Over 90° F.	Every 6 months.
		70° to 90° F.	Every 9 months.
		Under 70° F.	Every 12 months.
STB	Stable for 6 weeks at temperatures up to 158° F. Stable for 10 years in air-tight containers.	Routine surveillance to detect defects in drums.	
RH 195	Decomposes gradually; should be stored in cool, dry place.	Routine surveillance to detect defects in drums.	
Sodium hydroxide	Stable in tightly sealed drums; absorbs moisture and carbon dioxide.	Routine surveillance to detect defects in drums.	
DS2	Serviceable after 4 years storage in bulk containers or after 6 months storage in spray containers. Can be stored in all climatic conditions for at least 9 weeks.	Inspect after 9 weeks when stored in desert or tropic areas.	
BPL	Polymerizes at ambient temperature (70° F.) in about 3 months, producing an undesirable residue. Stable for long periods when refrigerated (40° F.).	Inspect as follows: monthly when stored at temperatures above 70° F.; every 3 months when stored at 70° F.; every 6 months when stored at 40° F. or lower.	

5.4. Decontamination of Biological Agents

Decontaminants and decontamination procedures for toxic chemical agents are usually effective against biological agents. Decontaminants are listed in *a* and *b* below and a brief outline of applicable methods for decontamination are listed in *c* below.

a. Chemical Decontaminants for Biological Agents.

Decontaminant	Application	Limitations	Remarks
Decontaminating agent, biological, beta-propiolactone (BPL).	Used primarily for decontamination of interiors of buildings and equipment under tarpaulins. The vapors of BPL liquid are applied by an insecticide sprayer. Two Corps of Engineer disseminators used for spraying BPL are sprayer, insecticide, push-cart-mounted, mist-type, gasoline-driven, 30 GPH; and sprayer, insecticide, skid-mounted, fog, gasoline-driven, 40 GPH. Spray 1 qt of BPL for each 4,000 cu ft. The minimum effective temperature is 40° F., and the minimum effective relative humidity is 70 percent. The exposure time is 2 hours at temperature of 70° F. or above (double exposure time for each 18° F. below 70° F.). Gastight sealing is not required; however, major openings must be sealed. After exposure the area should be well aerated before it is reoccupied. Aeration may require as long as 24 hours.	Vapors are highly toxic. Beta-propiolactone vapor will not penetrate cloth and similar material as effectively as will ethylene oxide. Care should be exercised while spraying not to let liquid BPL collect on surfaces, since some materials are affected by the liquid.	Before a building is reoccupied after decontamination with BPL vapor, it should be tested for residual vapor. This test is made by use of the blue dot detector tube of chemical agent detector kits. The test is identical to the one for mustard. Personnel should wear protective masks when exposed to BPL, and if they intend to remain in the area more than a few minutes they should also wear impermeable protective clothing.

c. Biological Agent Decontamination Methods—Continued

Item	Method	Remarks
	Immersion in or spraying with 2-percent bleach solution	Packaged food or food which is peeled or pared may be immersed or sprayed.
	Beta-propiolactone, ethylene oxide, formaldehyde vapor	Use on covered or bottled foods.
Personnel [4]	Bathing with soap and warm water	Remove clothing and shower thoroughly.[5]
	Washing with hypochlorite.	

[1] In five times the quantity used for ordinary delousing.
[2] To effectively decontaminate facepieces of protective masks, boil them in water. If boiling is impractical, wash in lukewarm soapy water, rinse in clear water, and then dry at room temperature.
[3] Should not be consumed until pronounced safe by a medical officer.
[4] Minor cuts and abrasions should be treated immediately.
[5] When showering, head should be held back to prevent runoff from passing over eyes, nose, and mouth.

★5.5. Radiological Decontamination

Radioactive contaminants cannot be made safe by chemical action. They must be removed or shielded if it is impracticable to wait for natural decay. Therefore, radiological decontamination is the process of reducing the hazard of radioactivity to a permissible level by removal and disposal of the contamination or by shielding over the contamination.

a. Protection of Radiological Decontamination Personnel. Personnel performing radiological decontamination should wear normal clothing, including caps and gloves. All clothing openings should be taped closed. The protective mask or other respiratory protective device should be worn in smoky or dusty areas. Dosimeters should be carried. Waterproof clothing should be worn when a wet decontamination method is used. Facilities should be available for personnel monitoring and decontamination, to include showers.

b. Agents for Removal Methods.

Decontaminant	Type	Remarks
Soapless detergent, soap, wetting agent	Detergent	Practicable for field use.
Gasoline, kerosene, water	Solvent	Practicable for field use.
Steam	Solvent	Practicable for field use.
Potassium hydroxide, sodium hydroxide, trisodium phosphate, sodium orthosilicate.	Solvent	Practicable for field use.
Acetone, alcohol, ether, paint remover	Solvent	Practicable for small-scale operations only.
Citrates, citric acid, sodium versenates, polypnosphates	Complexing agent	Practicable for small-scale operations only.
Aqua regia [1], hydrochloric acid [1], nitric acid [1]	Corroding agent	Practicable for small-scale operations only.

[1] To be handled by experienced personnel only.

c. Radiological Decontamination Equipment. Chemical Corps equipment used in radiological decontamination includes the 200- and 400-gallon power-driven decontaminating apparatus, portable water heater, and decontaminating brushes. Some other equipment useful in radiological decontamination is listed below.

Item	Use
Broom	Brushing dust from personnel, clothing, equipment, and surfaces.
Brush	Scrubbing and brushing (same as for broom).
Shovel	Removal, burial, or other disposal of contaminated objects and materials.
Fire or garden hose	Hosing and scrubbing operations; also for use with bulldozer or road grader in holding down dust.
Bulldozer	Large-scale removal, burial, or other disposal of contaminated objects.
Power-driven decontaminating apparatus.	Large-scale hosing and spraying of vital areas, buildings, vehicles and machinery.
Long-handled scraper	Scraping paint.
Steam jenny	Cleaning complicated machinery and greasy or hard dirt film surfaces.
Water-carrying or moving equipment	Moving water.
Containers	Waste movement and control.

d. Radiological Decontamination Methods (See part four of TM 3-220 for further information).

Method	Surfaces	Action	Technique	Advantages	Disadvantages
Water washing	All nonporous surfaces (metal, paint, plastic).	Acts as a solvent and erodes. Action faster if water is hot.	For gross decontamination use water shot from high pressure hose. Work from top to bottom to avoid recontamination and from upwind to avoid spray. Spray from distance of 15 to 20 ft. Use 30° to 45° angle on vertical surfaces.	All water equipment may be utilized. Allows operation to be carried out from a distance. Most readily available agent.	Runoff requires disposal. Carries contaminant into porous materials if permitted to soak in.
Using detergent solution.	Nonporous surfaces	Emulsifying agent. Wetting agent. (Action faster if solution is hot.)	Rub surface 1 minute and wipe with dry rag; use clean surface of the rag for each application. (Moist application is all that is desired.) Do not allow solution to drip onto other surfaces. Solution may be applied with a powered rotary brush or from distance by use of pressure sprays.	Dissolves films which hold contamination. Contamination may be reduced by 90 percent. Easily handled. More efficient than water alone.	Requires close contact with surface. Not efficient for longstanding contamination without scrubbing. Runoff requires disposal.
Steaming	Nonporous surfaces (especially painted or oiled surfaces).	Solution, erosion, and physical removal.	Work from top to bottom and from upwind. The cleaning efficiency of steam may be greatly increased by use of detergents.	Reduces contamination by about 90 percent on painted surfaces. Corps of Engineers steam jenny can be used.	Runoff requires disposal. Waterproof clothing necessary. Requires special equipment.
Scrubbing	Porous and nonporous surfaces.	Physical removal of contaminant.	Use in conjunction with other processes.	Used on "hot spots" following other processes. May he used on small objects and areas. Aided by detergents.	Slow and laborious. Erosive action on some surfaces.
Using complexing agents.	Nonporous surfaces	Forms soluble complexes with contaminant.	Use 3 percent (by weight) solution. Spray solution on surface. Keep surface moist 30 minutes by spraying periodically, then flush with water. Mix equal parts with mechanical foam for use on vertical and overhead surfaces.	Holds contamination in solution. Solution can be prepared in tank of power-driven decontaminating apparatus. Solution easily stored and used.	Requires application for 5 to 30 minutes. Little penetrating power. Little value on weathered surfaces. Difficult to keep in place on nonhorizontal surfaces.

Using caustic solution: Sodium hydroxide (lye), calcium hydroxide, potassium hydroxide.	Painted surfaces	Removes paint	Allow solution to remain on surface until paint softens, then wash off with water; remove remaining paint with long-handled scrapers. 1 lb of caustic in 2½ gal. of water removes about 100 sq ft of paint; the addition of 1½ lb of trisodium phosphate aids in removal; the addition of 3 oz of cornstarch holds solution to surface.	Time of contact required varies with contaminated surface—15 minutes to 2 hours. Can be prepared in steel tank of powerdriven decontaminating apparatus.	Can cause severe burns. Corrosive to aluminum or magnesium surfaces or rubber. Not recommended for vertical or overhead surfaces.
Using trisodium phosphate solution.	Painted surfaces	Removes paint	Apply hot 10 percent solution. When paint softens, flush from surface with water. Repeat as necessary.	Fast acting	Useful on walls and ceilings. Solution harmful to body tissue. Powder harmful if inhaled. Corrosive to aluminum or magnesium surfaces.
Using organic solvents: Kerosene, gasoline, alcohol, turpentine, acetone, ether, commercial paint remover.	Nonporous surfaces (greasy or waxed surfaces, paint or plastic finishes).	Dissolves oil and other organic materials. Also removes paint.	Immerse object in solvent or wipe with solvent. Wash in hot soapy water, then rinse in clear water.	Quick dissolving action. Recovery of solvent possible by distillation.	Vapors are toxic. Good ventilation required. Fire precautions required. Vapors are flammable.
Using inorganic acids: Hydrochloric acid, sulfuric acid.	Metal surfaces, especially those with porous deposits (rust or calcareous growth); circulatory pipe systems.	Strong dissolving action on metals and porous deposits.	Use dip-bath technique for movable objects. Keep acid at a concentration of 1 to 2 normal (9 to 18 percent hydrochloric acid, 3 to 6 percent sulfuric acid). (Reaction time on weathered surfaces should be 1 hour; on pipe systems, 2 to 4 hours.) Flush surface with water, neutralize or wash with hot soapy water, and then flush with water again.	Rapid and complete dissolving action.	Vapors are toxic. (Good ventilation required.) Liquid is harmful to the skin. Acid solutions should not be heated. Rust inhibitor required to prevent corrosion. Trained personnel required. Special equipment required.
Using acid mixtures: Hydrochloric acid or sulfuric acid with acetates or citrates.	Nonporous surfaces, especially those having porous deposits; circulatory pipe systems.	Dissolving action	Use same as inorganic acids. Mixture may consist of 1/10 gal. of hydrochloric acid, 1/5 lb of sodium acetate, and 1 gal. of water. Keep surface wet for 1 hour, then flush with water.	Dissolving action may reduce contamination of unweathered surfaces by 90 percent in 1 hour. Removes rust.	Weathered surfaces may require prolonged treatment. Harmful to personnel.
Vacuum blasting	Porous and nonporous surfaces.	Physical removal of contaminated surfaces.	Run unit over contaminated surface.	Safe and rapid. Contaminant controlled.	Wears away surfaces. Protective mask required.

Method	Surfaces	Action	Technique	Advantages	Disadvantages
Sandblasting	Nonporous surfaces	Physical removal of contaminated surfaces.	Wet sand prior to sandblasting. Keep removed material wetted down.	Satisfactory method for nonporous surfaces. Can be used for large-scale operations.	Wears away surfaces. Not feasible for porous surfaces. Spreads contamination. Protective mask and hood required.
Sanding, filing, grinding, planing, chipping.	Porous and nonporous surfaces.	Physical removal of contaminated surfaces.	Remove surface and control residue.	Reduces "hot spots"	Practical for small areas or objects only. Time-consuming. Protective mask and gloves required.
Using earthmoving operations.	Soil and loose rock	Physical removal of top layer of soil, with contaminant.	Remove contamination with bulldozers, road graders, and similar equipment.	Suitable for large areas if equipment is available.	Limited control of contaminated dust. Disposal problem may become acute due to large volumes involved. Equipment may become contaminated. Protective mask should be worn.
Brushing	Porous and nonporous surfaces.	Physical removal of loose contaminated dust.	Brush or sweep dust from surface.	Work may begin quickly. Rapid action. Brushes usually available.	Limited control of contaminated dust. Little or no removal of dust within pores of many porous surfaces. Protective mask should be worn.
Vacuum cleaning	Dry contaminated nonporous surfaces.	Removal of contaminated dust by suction.	Use conventional vacuum technique with efficient filter or field expedient. Siphon action.	Rapid. Good on dry, porous surfaces. Water not required. Contamination controlled.	All dust must be removed from exhaust system. Machine may become contaminated. Rubber gloves required for disposal of waste and filters.
Using ion exchange resins.	Fluids	Removes contaminant from solution.	Pass solution through prepared exchange column.	Concentrates contaminant.	Special equipment required.

c. Radiological Decontamination of Surfaces and Objects.

Item	Methods (In order of preference)	Remarks
Clothing	Brush (wipe); wash; vacuum clean	Brushing satisfactory for tactical use.
Buildings	Flush with water; wash with detergent and water; brush; steam clean.	Roofs and surrounding terrain more important than walls.
Terrain	Remove top 2 inches of surface; cover with 6 inches of uncontaminated earth.	Delay as long as possible before beginning.
Water	Engineer water supply point processes; in emergency, filter through 6 inches of clean sand and boil.	IM-141/PD not adequate for monitoring. Assume contaminated unless obtained at water supply point.
Food:		
Prepared, uncovered	None; treat as waste	Do not use.
In sealed containers	Clean container, monitor, open, and remonitor	Contamination cannot penetrate.
Heavy-skinned	Clean, monitor, then peel and remonitor	Contamination cannot penetrate.
Solid, uncovered	Pare, then monitor. Do not wash before paring or contamination will soak in.	Contamination cannot penetrate.
Personnel	Bathe and scrub; shower; wipe with damp cloth.	Perform as soon as practicable.
Painted or waxed surfaces	Flush with water; wash with water and detergents; use complexing agents; use organic solvents.	
Bare metal or wood surfaces.	Flush with water; wash with water and detergents; use complexing agents.	Do not soak; wash rapidly.
Greasy surfaces	Use organic solvent; steam clean	Decontaminate only as absolutely necessary.

f. Radiological Decontamination of Large, Hard Surfaces (e.g., roads, buildings).

Method	Rate (sq ft/equipment hour)	Residual number for all dose rates unless stated otherwise
Street sweeping	6×10^4	0.07
Vacuum sweeping	3×10^4	0.04
Airbroom sweeping [1]	4×10^4	0.03
Motorized flushing, [2] 500 g.p.m	6×10^5	0.045
	3×10^5	0.03
	1.2×10^5	0.015
Hosing, [3] 100 g.p.m	1.2×10^5	0.06
	7.2×10^4	0.04
	3.6×10^4	0.02
	1.8×10^4	0.015
Hosing of roofs: [4]		
Sloping	3.6×10^4	0.09
	1.8×10^4	0.06
	9×10^3	0.04
Flat, tar and gravel.		
Standard dose rate:		
300 rad/hr	9×10^3	0.6
	6×10^3	0.3
	4.5×10^3	0.2
	3×10^3	0.1
1,000 rad/hr	9×10^3	0.2
	6×10^3	0.1
	4.5×10^3	0.08
	3×10^3	0.05
3,000 rad/hr	9×10^3	0.06
	6×10^3	0.03
	4.5×10^3	0.02
	3×10^3	0.01
Scrubbing after hosing [5]	2×10^3	0.008
Steam cleaning [5]	6×10^1 to 3×10^3	0.15
Hot liquid cleaning [5]	2×10^3	0.008

[1] Airbroom sweeping causes enormous downwind resuspension and is only usable where this hazard can be tolerated.

[2] Motorized flushing can be used where water supply has been cut off, is faster than hosing, and provides the fewer operations required with more shielding, but is less flexible and required equipment is less available.

[3] Hosing assumes 1½-inch hose, three men per hose.

[4] Slope and smoothness of a roof are important. On a smooth sloping roof, lobbing of a heavy rain at 45 p.s.i. from the ground is as effective as direct hosing at roof level (70 p.s.i.).

[5] Hot liquid cleaning, steam cleaning with detergents, and hosing plus scrubbing have approximately the same characteristics.

g. Radiological Decontamination of Unpaved Areas.

Procedure [1]	Rate (sq ft/equipment hr)	Residual number for all dose rates
Motorized scraping, 2-inch cut [2]	7,500	0.036
Motorgrader scraping, 2-inch cut, [3] followed by motorized scraping	4,000	0.124
Scraping with bulldozer [4]	8,000	0.2
Plowing, four share gang plow, 10-inch cut [5]	24,000	0.15
Earth filling, 6-inch fill [6]	3,000	0.15
Scraping, farm-type tractor, with one shovel man	3,000	0.15
Scraping, jeep-towed, manual bucket, with two shovel men	3,000	0.15
Scraping, hand shovel and wheelbarrow:		
Light soil with some sod	450	0.15
Rocky soil with shrubs	280	0.15
Lawns	480	0.15
Rocky ground	280	0.15
Soggy ground	120	0.15
Scraping with skiploader, with one shovel man	8,000	0.15

[1] Combinations. The residual number is the product of the individual residual numbers. The time required is the sum of the times for each method, unless techniques are employed simultaneously.

[2] Rate of operation depends on distance to dumping area and roughness of soil. Plan to keep in constant operation by avoiding backing. The most efficient technique; effective even on rough terrain.

[3] Soil cannot be hardened or compacted. Best to perform series of concentric rings (spiral effect), pushing windrow further out from the vital area. Otherwise, windrows must be removed by other equipment. Not useful on rough terrain.

[4] Flexible, especially on rough terrain, for digging and backfilling disposal trenches and sumps. Good prime mover. Slow operation.

[5] Free of waste disposal. Soil becomes less trafficable and waste may be redistributed. Useful only on tillable terrain.

[6] Useful where soil cannot be scraped or turned (e.g., rocky land, or around railroad tracks). Good in filling depressions. No other advantages compared to scraping.

h. Radiological Waste Disposal. In a peacetime situation, consult TM 3-260 for instructions on disposal which, in general, will be done by specialized installations, not locally. In a wartime situation, the following methods are applicable:

Method	Technique	Area considerations	Advantages and disadvantages
Dilution into lakes and rivers.	Dump solids and running liquids into the body of water.		Temporary tactical expedient only; continued use in populated areas will produce unfavorable results.
Burial at sea.	Place material in reasonably strong leakproof containers, preferably of concrete. Fill completely, seal, and sink in deep water (6,000 feet or more).	Areas close to large bodies of water.	Requires considerable logistic support.
Land burial.	Place material in sealed containers, if possible; then emplace in caves, if possible, or in deep trenches; cover with at least 4 feet of soil. Cap with 1 inch of asphalt, if possible; otherwise, keep vegetation from the top of the material. The bottom of the burial site should be lined with 6 inches of gravel to minimize leaching. Mark well and report the location and other pertinent data. Drainage ditches may be dug to bring liquid wastes to the same trench (sump). Do not mix with other types of contamination (e.g., chemical).	Arid clay soils are best. Do not choose sandy or rocky soils. Area should have good surface drainage. Avoid areas subject to flooding or near bodies of water. Choose sites well above water table. Sites should be located near collection points, but not in critical terrain. Care must be taken not to disrupt underground facilities.	Most permanent form of disposal; requires least logistic support of all practical methods. ★

5.6. Personnel Decontamination Stations

Field-type personnel decontamination stations should be established to provide facilities for decontamination of personnel who have become contaminated with CBR agents. For detailed procedures and description of station, see FM 21-40 and FM 21-48.

Section II. CLOTHING IMPREGNATION

5.7. References

For information on chemical impregnation of clothing, see FM 3-85, TM 3-281, and TM 3-303.

5.8. Operating Data

a. General. The chemical processing company is equipped with two clothing impregnating plants, each capable of processing approximately 4,000 pounds (600 uniforms) per 24-hour day. Each uniform is considered to consist of a pair of full long underwear, a pair of socks, a pair of fabric gloves, and a one-piece or two-piece herringbone twill outfit. Chemical processing units usually operate in conjunction with quartermaster laundry units.

b. Clothing Impregnating Plant. The M2A1 and M2 clothing impregnating plants employ aqueous suspension impregnation methods.

(1) *Operating supply requirements.* The weight and storage space requirements for operating supplies needed to impregnate approximately 4,000 pounds of clothing during a 24-hour operating day are shown below.

Supplies Required for 24-Hour Day Operation of M2A1 or M2 Impregnating Plant

Item	Gross weight (lb)	Floor space (sq ft)	Volume (cu ft)	Remarks
Boiler water (400 gallons)	3,342			3000-gallon canvas tank (11-foot diameter) normally is used.
Chlorinated paraffin	660	12.0	23.4	In 55-gallon drums stored on side, 2 drums high.
72 octane gasoline (fuel for 2 electric generators).	770	12.0	36.0	In 55-gallon drums stored on side, 2 drums high.
No. 3 fuel oil (for steam generator)	2,360	18.0	60.0	In 55-gallon drums stored on side, 2 drums high.
Impregnite, XXCC3	850	8.5	27.0	In metal containers, 16 inches in diamter and 26 inches high, stored on side, 2 containers high.
Polyvinyl alcohol, granular	32	3.0	3.3	In 120-pound drums 16 inches in diameter and 30 inches high, stored on side.

CHAPTER 6
RADIOLOGICAL DEFENSE

Section I. EQUIPMENT AND RADIOACTIVE SOURCES

★6.1. Radiac Instruments [1] (Excluding Radiac Calibrators)

Item	Capability	Maximum permissible error	Battery requirements
AN/PDR-27J radiac set (IM-141) (AN/PDR-27A through I are standard B).	Measure gamma dose rate; detect presence of beta.	±10%	6 ea BA-30, for AN/PDR-27J set.
AN/PDR-39 radiac set (standard B)	Measure gamma dose rate	±15%	2 ea BA-51. 1 ea BA-42. 1 ea BA-1278/U. 1 ea BA-1277/U.
AN/PDR-54 radiac set (standard C) (IM-154)	Measure alpha dose rate alone or in the presence of beta and gamma.	Note 2.	2 ea RM-42 Mallory. 2 ea RM-3 Mallory.
IM-9/PD radiacmeter	Measure total gamma and X-ray dose.	±5%	None.
IM-93/UD radiacmeter	Measure total gamma dose	±10%	None.
IM-174/PD radiacmeter. (replaces IM-108( )/PD, which is standard B).	Measure gamma dose rate	±20%	2 ea BA-1318/U. 1 ea BA-1288/U.
IM-147/PD radiacmeter	Measure total gamma dose	±10%	None.
IM-156( )/PD radiacmeter (formerly part of radiac set AN/PDR-53) (standard C).	Measure alpha; will also detect beta and gamma radiation. Intended for alpha surveys.	Note 2	4 ea BA-261. 2 ea BA-1328/U. 2 ea TR-115.
PP-1578A/PD charger, radiac detector	Charge pocket dosimeter, such as radiacmeters IM-9, IM-93, and IM-147.	NA	None.
AN/PDR-60 (IM-170) (Pac-1S, Pac-1SA)	Measure alpha dose rate; is influenced by presence of beta and/or gamma radiation.	Note 2	5 ea BA-30.

[1] For basis of issue and authorized allowances, see applicable TOE and TA.
[2] Accuracy for alpha measurements is dependent upon energy of radiation and surface monitored. It may range from 5 to 20 percent under strictly controlled conditions. ★

★6.2. Characteristics of Radioactive Source Sets and Test Samples*

Item and model	Description	Service or branch resp	Standard	Sealed source	Primary radiation type	Activity	Isotope	Half-life
Radioactive test sample, MX-1083/PDR-27.	Plastic rod 3/8 in. x 5 in. Purple in color on one end containing radioactive material.	Army Signal Corps (Note 6)	B	Note 1	γ	5μc	Co^{60}	5.3 yr
Radioactive test sample, MX-1083B/PDR-27, MX-1083C/PDR-27J.	Same as MX-1083/PDR-27	Army Signal Corps (Note 6)	A	Note 2	γ	7μc	Ra^{225}	1,620 yr
Radioactive source, M6.	Stainless steel retainer 1 1/16 in. diam at large end, 5/16 in. diam at small end, and 1 1/16 in. long. Source is in large end.	Army Cml Corps	A	No	β	25–40 mc	Sr^{90} Y^{90}	25 yr
Calibrator, radiac, TS-1230A.	Consists of a source, two masks and a carrying case. See note 4.	Army Cml Corps	A	No	α	Note 4	Pu^{239}	24,300 yr
Radioactive source set, M3.	Consists of source set (pig and source) tongs and two boxes. One box for tongs and one for source. Total weight 170 lb and volume 5.15 cu ft. Source box is approx 18 in. x 18 in. x 18 in.	Army Cml Corps	A	Yes	γ	100 mc	Co^{60}	5.3 yr
Radiac calibrator set, AN/UDM-1A.	A very large and heavy device weighing 1,025 lb and occupying 48.76 cu ft. Consists of a source chamber, a track to support the chamber, a positioning carriage, a carriage track, and an optical system.	Navy Bushops	A	Yes	γ	120 c	Cs^{137}	30 yr
Calibration source AN/UDM-6.	Set of four sources in carrying case.	Army Cml Corps	A	NA	γ	Varies	Pu^{239}	24,300 yr

Definition of symbols:

c	Curie	Sr^{90}	Strontium 90	Cs^{137}	Cesium 137
mc	Millicurie	Y^{90}	Yttrium 90	α	Alpha (particle) emitter
μc	Microcurie	Ra^{226}	Radium 226	β	Beta (particle) emitter
NA	Not applicable	Pu^{239}	Plutonium 239	γ	Gamma (ray) emitter
Co^{60}	Cobalt 60				

Notes.

1. This source prior to 20 May 1959 was not sealed. Those after 20 May 1959 are sealed sources.
2. This source prior to 3 June 1959 was not sealed. Those after 3 June 1959 are sealed sources.
3. The radiac calibrator TS-784( )/PD source M6 is a component of the set, not to be removed under any circumstances. This source is extremely hazardous.
4. This source contains 4μc of Pu^{239} and is designed to have a total surface alpha activity of 4,000,000 ±10% counts per minute. The calibrator is equipped with two attenuator masks. Mask A reduces counts by a factor of 5 and Mask B by a factor of 50. The combination reduces by a factor of 100.
5. The TS-1230A is not a sealed source and must not be touched on the contaminated surface because of the hazard of ingested alpha emitters. Observe instruction and warnings before using the source.
6. Also Navy issue.
7. Eight or fewer sets may be possessed under a general license with no AEC or Surgeon General control.

* For serviceability standards, see SB 3-30-300. ★

Regulated by AEC	Regulated by Surgeon General	Lifetime control required	Quantitative control required	Publications regarding	Use	Basis of issue	Remarks
Yes	Yes	Yes	NA	TM 11-487J TM 11-5543 TB CML 54	Used to determine whether radiac set AN/PDR-27( ) is functioning properly. Also used for training.	One per AN/PDR-27( ) in lieu of MX-1083B/PD.	Note 1 Note 6
No	Yes	Yes	NA	TM 11-487J TM 11-5543 TB CML 55	Same as MX-1083/PDR-27.....	One per AN/PDR-27.	Note 2 Note 6
Yes	Yes	Yes	NA	TB CML 52 SB 11-477	Used in the TS-784(A) to calibrate standard radiac instruments.	One per TS-784( ), radiac calibrator.	Note 3
Note 5	Yes	Yes	NA	TM 11-6665-207-12 TB CML 77	Used for calibration of alpha imstruments such as IM-156( )/PD, IM-154, and IM-170.	One per radiacmeter, IM-156( )/PD.	Note 4 Note 5
Yes	Yes	Yes	NA	TM 3-6665-207-12	Used for calibration of low dose rate instruments measuring gamma radiation. Also used for training.		
Yes	Yes	Yes	NA	BUSHIPS NOTICE 9673	Used to calibrate radiac instruments of both low and high range and the TS-784( )/PD radiac calibrator.	Navy unk.	
Note 7	Note 7	Note 7	Yes	In preparation.....	Use to calibrate IM-154 and IM-170.	Undetermined.	

★6.3. Calibration of Radiac Instruments [1]

Instrument to be calibrated and reference publication	Calibration device [2] and reference publication	Suggested calibration points	Maximum permissible deviation from calibration point [3]	Approx. time required per instrument
IM-174/PD.....TM 11-6665-213-12 TM 11-6665-213-35	AN/UDM-1A.....BUSHIPS NOTICE 9673	6, 60, 300 rad/hr.....	±10%	15 min
	TS-784( )/PD.....TM 11-6665-204-12	As per chart with each TS-784( )/PD.....	.....	15 min
AN/PDR-39( )....TM 11-5514A	AN/UDM-1A.....BUSHIPS NOTICE 9673	4, 40, 400, 4K, 40K mrad/hr [4].....	±15%	30 min
	M3 source set.....TM 3-6665-214-15	4, 4, 400, mrad/hr (lower scales only) [4].....	.....	30 min
	TS-784( )/PD.....TM 11-6665-204-12	As per chart with each TS-784( )/PD.....	.....	20 min
AN/PDR-27J.....TM 11-6665-209-15	AN/UDM-1A [5].....BUSHIPS NOTICE 9673	.4, 4, 40, 400 mrad/hr [4].....	±20%	20 min
	M3 source set [5].....TM 3-6665-214-15	.4, 4, 40, 400 mrad/hr [4].....	.....	30 min
	TS-784( )/PD [5].....TM 11-6665-204-12	As per chart with each TS-784( )/PD.....	.....	15 min
IM-156( )/PD.....TM 11-6665-207-12 (SRJ) TM 11-6665-207-35	TS-1230( ).....TM 11-6665-207-12 TM 11-6665-207-35	5, 25, 50, 3,000 mrad/hr.....	Note 6	30 min
IM-154.....TM 11-6665-208-15 (AN/PDR-54) (Pac-3G)	AN/UDM-6.....TM in preparation.....	As indicated on calibration set.....	Note 6	30 min
IM-170.....Manufacturer's (AN/PDR-60) technical manual. (Pac-1S, 1SA)	AN/UDM-6.....TM in preparation	As indicated on calibration set.....	Note 6	30 min
TS-784( )/PD [7].....TM 11-6665-204-12 TM 11-6665-204-35	AN/UDM-1A [8].....BUSHIPS NOTICE 9673	4, 40, 400, 4K, 40K mrad/hr.....	NA	2 hr [9]

[1] Personnel required: Safety officer and operator. Not more than five operators per safety officer. Safety officer must be qualified by Lexington Signal Depot through special instruction.
[2] In most cases a screwdriver will be necessary for calibration in addition to the calibration device.
[3] Readings on instrument being calibrated must be adjustable to within indicated tolerances at calibration points, or instrument is inoperational.
[4] Any point(s) on the meter may be used for calibration. The exact distance from the meter to the source is calculated, using the source strength and the inverse square law.
[5] Wrenches which fit the retaining nuts on the high dose-rate probe are also required.
[6] Accuracy is dependent upon energy of radiation and surface monitored. It may range from 5 to 20 percent under strictly controlled conditions.
[7] The TS-784( )/PD is a secondary transfer standard and is calibrated against an Army secondary reference standard, as the AN/UDM-1A.
[8] At least one of each type instrument to be calibrated with the TS-784( )/PD is also required.
[9] Time required to calibrate the TS-784( )/PD for the calibration of one instrument. ★

Section II. RADIOLOGICAL SAFETY (TECHNICAL)

★ See FM 3-15, Nuclear Accident Contamination Control for additional information ★

6.4. Standards for Protection

References:

Paragraph 20.101, Title 10, Part 20, Code of Federal Regulations.

Paragraph 20.106, Title 10, Part 20, Code of Federal Regulations.

AR 40-580.

AR 40-582.

TB MED 254.

6.5. Formulas for Concentration of Radioactive Isotope

Determination of Airborne Long-Lived Activity.

1. To determine the counts per minute due a long-lived airborne radioisotope, the following equation is used:

$$C_{LL}=\frac{C_2-C_1e^{-\lambda\Delta t}}{1-e^{-\lambda\Delta t}}$$

where: C_{LL} = counts per minute of long-lived material (greater than 24 hours).
C_2 = second count of collected air sample (normally taken 24 hours after original count).
C_1 = original count of collected air sample (normally taken 4 hours after collection).
λ = decay constant of thoron (equals 0.0655).
t_1 = time original count was taken (in hours).
t_2 = time second count of sample was taken (in hours).
Δt = difference between t_2 and t_1 (t_2-t_1).
e = base of natural logarithms (2.7183).

2. To convert counts per minute into disintegrations per minute per cubic centimeter (d/m/cc), the following equation is used:

$$d/m/cc=\frac{c/m}{V\times E_f\times E_c}$$

where: $d/m/cc$ = disintegrations per minute per cubic centimeter.
c/m = counts per minute due long-lived material.
V = volume of air sampled in cubic centimeters.
E_f = efficiency of collector or filter.
E_c = efficiency of counter (geometry).

3. To convert disintegrations per minute per cubic centimeter into microcuries per cubic centimeter, the following is used:

$$d/m/cc\times 4.55\times 10^{-7}=\mu c/cc$$

where: $\mu c/cc$ = microcuries per cubic centimeter.

6.6. Storage of Radioactive Material

Reference: AR 700-323.

6.7. Transportation of Radioactive Material

Reference: "Handbook of Federal Regulations Applying to Transportation of Radioactive Materials," May 1958.

6.8. Disposal of Radioactive Waste Material

References: Paragraph 20.301, Title 10, Part 20, Code of Federal Regulations and AR 755-380.

6.9. Marking of Storage and Contaminated Areas

Reference: Section IV, AR 385-30.

Section III. RADIOLOGICAL SURVEY

★6.10. Air-Ground Correlation Factors (AGCF)

Height above ground (ft)	Aircraft						
	OH-13 or UH-1	OH-23	UH-19	O-1	U-6	CH-34	CH-21
100	2.2	2.2	2.4	2.2	4.1	5.2	2.6
200	3.2	3.4	3.6	3.3	6.2	7.8	3.8
300	4.5	4.7	5.0	4.6	8.7	10.9	5.4
400	6.2	6.5	7.0	6.3	11.9	15.1	7.4
500	8.2	8.5	9.1	8.3	15.7	19.8	9.7
1,000	29.0	30	32	29	55	70	35
2,000	301	314	336	305	577	728	358
3,000	2,580	2,688	2,880	2,616	4,944	6,240	3,072

Notes.

1. To obtain ground dose rate, multiply air dose rate by the factor for the height and type aircraft.
2. The air-ground correlation factors listed above are used as a guide only. Actual air-ground correlation factors should be computed when radiological surveys are conducted. The above table should be used only when measurement of the AGCF is impossible.
3. All aircraft have approximately the same area coverage capability of between 50 and 175 square miles per hour per aircraft, depending upon the degree of detail required and the degree of ground contamination.★

★6.11. Location of Survey Meter and Monitor During Aerial Survey

During aerial survey the radiacmeter IM-174/PD will be used. The meter should be at the monitor's waist, face-up, and hanging from the monitor's neck by the meter's carrying straps.

Aircraft	Monitor Location
UH-1A	In passenger compartment, second seat from the left side of the aircraft.
UH-1D	In passenger compartment, second seat from the left side of the aircraft.
OH-13	Right seat.
OH-23	Left seat.
CH-21	Seat at station 299.
UH-19	Seat at station 136.
O-1	Rear set at station 61.
U-6	Right rear seat. [1]
CH-34	Seat at station 100.[1]

[1] Assumes that the fuel tank under this location is full. ★

★6.12. Aircraft Survey Capabilities

Rescinded★

6.13. Approximate Transmission Factors for Vehicles for Residual Gamma Radiation

Vehicle	Transmission factor
Armored personnel carrier (steel)	0.6
Tanks	
Light	0.2
Medium or heavy	0.1
Trucks	
¼-ton	0.8
¾-ton	0.7
2½-ton	0.6
4- to 7-ton	0.5

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2. Enter the table at 5 under the 2^n column and read the value of 2.4 under the n column.

3. $n=\frac{X}{X_{\frac{1}{2}}}$ $X=n\ (X_{\frac{1}{2}})=2.4\ (2)=\underline{4.8\text{ cm.}}$

(*d*) Same as *b*(1)(*d*) above.

1. $R=\frac{R_o}{2^n}$ $2^n=\frac{R_o}{R}=\frac{100}{25}=4.$

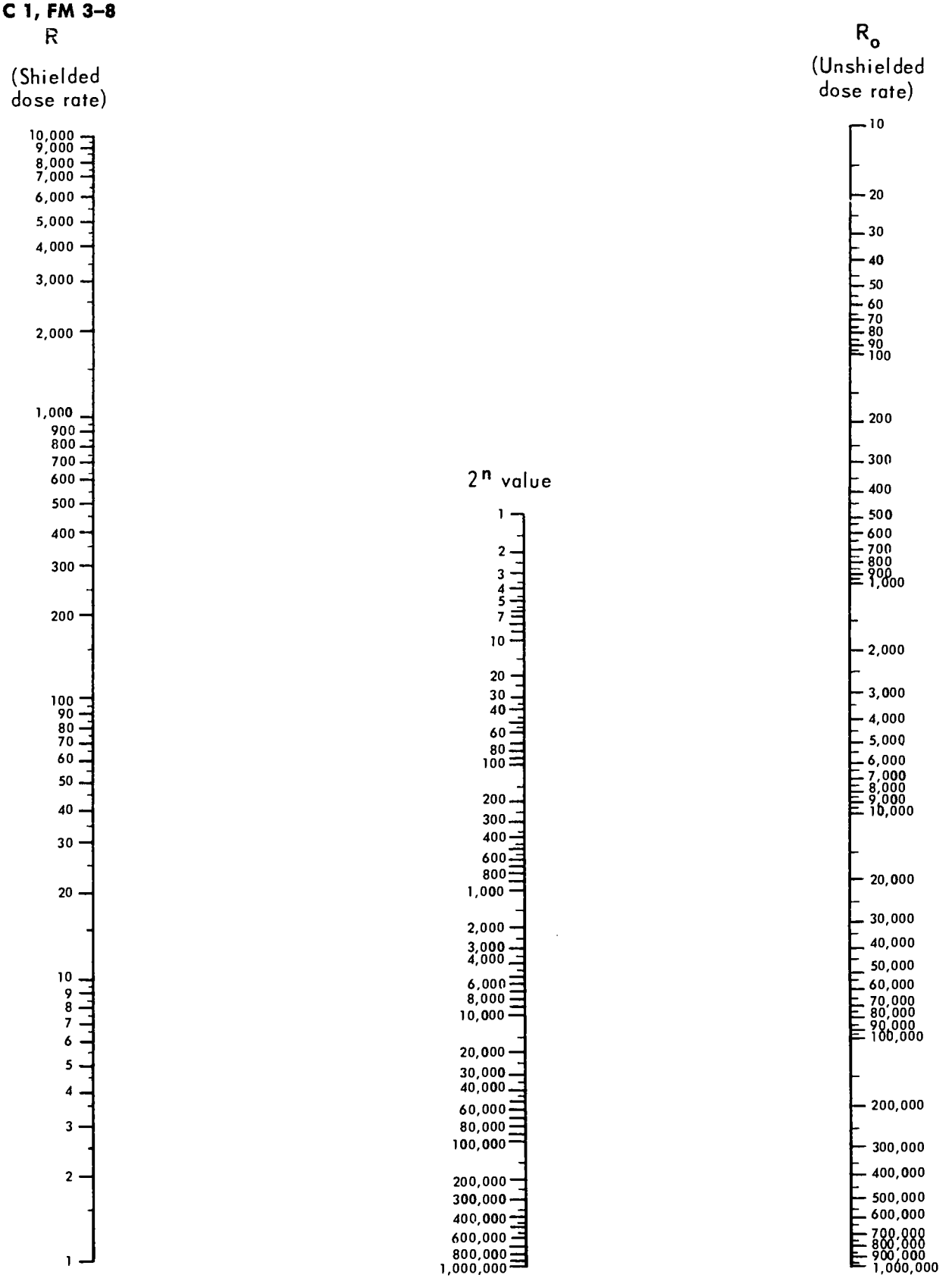
2. Enter the table at 4 under the 2^n column and read the value of 2 under the n column.

3. $n=\frac{X}{X_{\frac{1}{2}}}$ $X_{\frac{1}{2}}=\frac{X}{n}=\frac{6}{2}=\underline{3\text{ cm.}}$

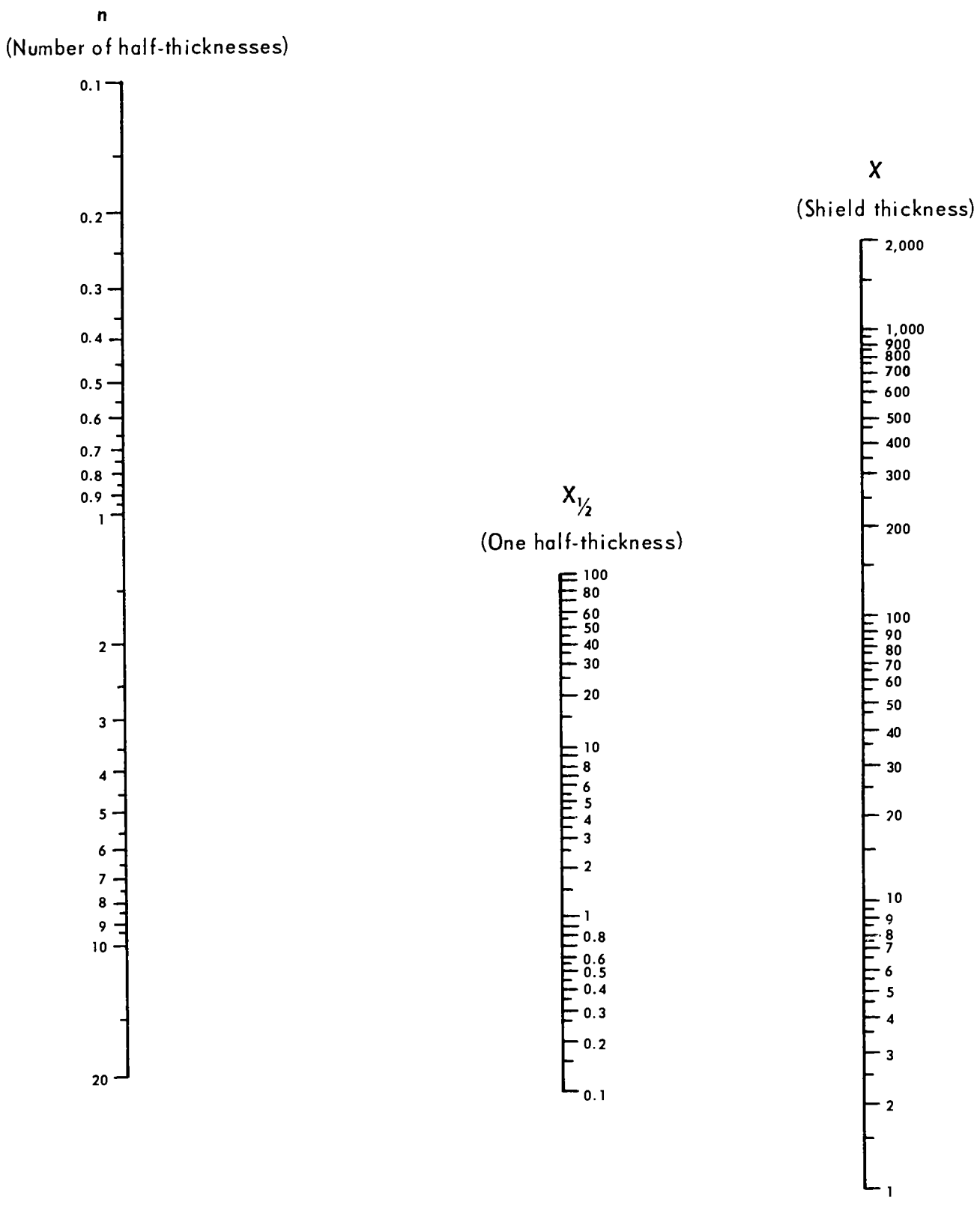
★*c. Solution by Nomogram.* The methods covered in *a* and *b* above require that the user possess a background in algebra, including transposing equations. Since there may be times when the user will not possess such a background, the nomograms in figures 3.1 and 3.2 allow solutions with a minimum of calculations. The user needs only to follow the instructions given in *d* below to obtain solutions of reasonable accuracy. See *a* above for explanation of symbols.★

★*d. Instructions for use of Shielding Nomograms.*

To find	Given	Procedure
		A
X (shield thickness)	$X_{\frac{1}{2}}$, R, R_o	Step 1. Connect the values of R and R_o on their respective scales (fig. 3.1) with a straightedge. At the intersection of the straightedge with the 2^n scale, determine value on 2^n. Step 2. Consult the 2^n table (par. 6.22). Using the value for 2^n determined in step 1, select the nearest value for n. Step 3. Connect the value for n, from step 2, with the value of $X_{\frac{1}{2}}$ on their respective scales (fig. 3.2) with a straightedge. At the intersection of the straightedge with the X scale, read the shield thickness required.
		B
$X_{\frac{1}{2}}$ (material half-thickness)	X, R_o, R	Step 1. Same as step 1, procedure A. Step 2. Same as step 2, procedure A. Step 3. Connect the value for n, from step 2, with the value of X on their respective scales (fig. 3.2) with a straightedge. At the intersection of the straightedge with the $X_{\frac{1}{2}}$ scale, read the half-thickness of the shielding material.
		C
R_o (unshielded dose rate)	R, X, $X_{\frac{1}{2}}$	Step 1. Connect the values of X and $X_{\frac{1}{2}}$ on their respective scales (fig. 3.2) with a straightedge. At the intersection of the straightedge with the n scale, determine the value of n. Step 2. Consult the 2^n tables (par. 6.22). Using the value for n, select the nearest value of 2^n (interpolate if necessary). Step 3. Connect the value for 2^n, from step 2, with the value of R on their respective scales (fig. 3.1) with a straightedge. At the intersection of the straightedge with the R_o scale, determine the unshielded dose rate.
		D
R (shielded dose rate)	R_o, X, $X_{\frac{1}{2}}$	Step 1. Same as step 1, procedure C. Step 2. Same as step 2, procedure C. Step 3. Connect the value for 2^n, from step 2, with the value of R_o on their respective scales (fig. 3.1) with a straightedge. At the intersection of the straightedge with the R scale, determine the shielded dose rate.★



★*Figure 3.1. Nomogram relating unshielded dose rate, shielded dose rate, and number of half-thicknesses in a shield.*



★*Figure 3.2. Nomogram relating shield thickness, shield half-thickness, and number of half-thicknesses in a shield.*

6.18. Dose Buildup

a. Area Source. Data not available.

b. Point Source. To determine the amount of material required to shield against gamma radiation from a point source.

(1) Place between the source and the radiacmeter the amount of material listed in paragraph 6.20 to shield against beta radiation.

(2) Measure the strength of the source with a radiacmeter, keeping the material used to shield against beta radiation midway between the source and the measuring device.

(3) To compensate for dose buildup, due to the scattering of gamma photons within the shielding material, determine the transmission factor necessary to reduce the dose rate to the desired level.

(4) *Example:*

R_o (unshielded dose rate) = 450 mrad/hr

R (desired dose rate) = 2 mrad/hr

Energy of radiation = 0.8 MEV

Shielding material = Concrete

(*a*) Determine the transmission factor.

$$TF = \frac{R}{R_o} = \frac{2}{450} = .0044$$

(*b*) Enter the appropriate table in paragraph 6.19, depending on the energy of the radiation. Interpolate between tables if necessary.

(*c*) Amount of concrete material required for a transmission factor of .0044 (use .005):

Energy 0.5 MEV (Par. 6.19*a*) = 46 cm

Energy 1 MEV (Par. 6.19*b*) = 56 cm

Energy 0.8 MEV (Interpolate between 46 and 56 cm) = 52 cm

6.19. Centimeters of Material Required for Shielding to Include Compensation for Dose Buildup

a. Centimeters of Material (.5 MEV).

Transmission factor	Lucite	Water	Concrete	Aluminum	Iron	Lead
0.5	47	28	13	10	2.5	0.5
0.3	54.5	38	17.5	13.8	3.8	.88
0.1	70	57	26	21	6.0	1.6
0.08	------	60	27.5	22.5	6.6	1.72
0.06	------	65	29.5	24	7.3	1.9
0.04	------	70	32.4	26.8	8.1	2.2
0.02	------	80	37	30.5	9.5	2.6
0.009	------	92	42	35	11	3.1
0.007	------	94	43.8	36.5	11.5	3.28
0.005	------	98	46	38	12.0	3.5
0.003	------	105	49	41	13.2	3.8
0.001	------	120	56	47	15.0	4.5
0.0008	------	122	57	48	15.6	4.6
0.0006	------	126	58.7	49.5	16.1	4.75
0.0004	------	132	61	51.8	16.8	5
0.0002	------	138	65	55	18	5.4
0.00009	------	148	69.5	59	19.5	5.87
0.00007	------	152	71	60.5	19.9	6
0.00005	------	156	73	62	20.5	6.2
0.00003	------	162	76	65	21.3	6.5
0.00001	------	175	82	70	23.0	7.1

b. Centimeters of Material (1 MEV).

Transmission factor	Lucite	Water	Concrete	Aluminum	Iron	Lead
0.5	33	28	13	11	3.5	1.5
0.3	45	42	19.5	16	5.2	2
0.1	70	65	30	26	8.5	3.8
0.08	73	68	32	28	9.2	4
0.06	78	74	34.5	30	10	4.5
0.04	85	81	38	33	11	5
0.02	97	93	44	38.8	13	6
0.009	------	107	51	44.5	15	7
0.007	------	111	53	46.5	15.5	7.5
0.005	------	117	56	49	16.5	8.0
0.003	------	125	60	52.5	17.7	8.7
0.001	------	144	69	60	20.5	10.3
0.0008	------	148	70	62	21	10.5
0.0006	------	153	72.5	64	21.7	11
0.0004	------	160	75.5	67	22.7	11.5
0.0002	------	172	80.5	71.5	24.4	12.4
0.00009	------	185	86.5	77	26.3	13.4
0.00007	------	188	88.5	78	27	13.7
0.00005	------	195	91	81	28	14
0.00003	------	203	95	84	29	15
0.00001	------	220	104	91	32	16.5

c. Centimeters of Material (2 MEV).

Transmission factor	Lucite	Water	Concrete	Aluminum	Iron	Lead
0.5	33	32	15	13	4	2
0.3	47	49	23	18	6.5	3.3
0.1	75	80	37	32	11	6
0.08	82	84	40	35	11.9	6.5
0.06	88	90	43	38	13	7.2
0.04	97	101	48	42	14.5	8.2
0.02	115	118	57	50	17.2	9.7
0.009	132	138	65	58	20.2	11.5
0.007	139	143	68	61	21	12
0.005	147	150	72	65	22	12.8
0.003	160	163	78	70	24	14
0.001	------	190	90	80	28	16.2
0.0008	------	193	92	83	29	16.7
0.0006	------	200	95	86	29.8	17.3
0.0004	------	209	99	90	31	18.2
0.0002	------	224	107	97	33.5	19.5
0.00009	------	242	115	104	36.2	21.4
0.00007	------	247	118	107	37	21.8
0.00005	------	255	122	110	38	22.5
0.00003	------	265	127	115	40	23.7
0.00001	------	290	138	125	44	26

d. Centimeters of Material (3 MEV).

Transmission factor	Lucite	Water	Concrete	Aluminum	Iron	Lead
0.5	35	35	16	13	4.5	2
0.3	55	53	25	21	7	3.5
0.1	88	90	43	37	12.2	6.6
0.08	95	96	45	39	13.5	7.3
0.06	103	105	50	43	14.8	8
0.04	115	118	56	48	16.5	9
0.02	134	140	66	57	19.5	10.6
0.009	156	163	77	67	23	12.5
0.007	163	170	80	70	24	13.2
0.005	173	180	85	74	25.5	14
0.003	186	195	92	80	27.5	15.2
0.001	215	227	105	93	32	17.9
0.0008	222	233	108	95	32.8	18.5
0.0006	230	240	113	98	34	19.2
0.0004	240	252	117	103	35.5	20.1
0.0002	258	270	125	112	38.2	21.8
0.00009	280	293	136	121	41.5	23.7
0.00007	286	300	138	123	42.5	24.4
0.00005	295	308	143	128	44	25
0.00003	308	323	150	133	46	26.5
0.00001	335	352	165	145	50	29

6.20. Shielding (CM) for Beta

Element	Energy (MEV)					
	0.5	1	1.5	2	3	4
Lucite	0.2	0.4	0.6	0.8	1.3	1.7
Wood (soft)	.3	.7	1.2	1.6	2.5	3.3

6.21. Shipment of Point Sources

a. When any radioactive material is shipped or transported, it must be shielded and packaged in accordance with ICC regulations (par. 6.7).

b. An exception to *a* above would be in a theater of operations at which time military directives would govern.

★*c.* To compute the shielding and size of container, assume that military directives dictate that the dose rate at the surface of the outside of the container will not exceed 200 millirad per hour and 10 millirad per hour 1 meter from the surface.★

(1) Determine the amount of shielding necessary, including dose buildup, to reduce the initial dose rate to 200 millirad per hour at a point away from the source that is equal to or greater than five times the largest linear dimension of the source.

(2) When actually shielding the source, place the shielding material next to the source.

(3) Package the shielding source in a shipping container that has a radius in all directions, from the center, equal to the distance determined in (1) above. The shielded source must be located at the center of the shipping container. Packing material is used to fill in around the shielded source.

					skin is known as farcy, and generalized infection is known as glanders.				
★ Psittacosis (parrot fever, ornithosis).	Psittacosis	Virus	Humans and birds.	6-14 days; occasionally 3 or 4 weeks.	Onset may be sudden or gradual. Influenzalike, headache, sore throat, nonproductive cough, chills, physical signs of pneumonia, backache, constipation, weakness, prostration, and sometimes delirium.	6-60 days	10% or less. Death more common in persons over 30.	Broad spectrum antibiotics, such as chlortetracycline or oxytetracycline.	Disease not highly contagious. Transfer from man to man may occur from close contact. The epidemic problem is with birds.
Smallpox (variola).	Smallpox virus.	Virus	Humans	7-14 days. Commonly 12 days.	Severe fever, blisters of the skin, backache, prostration.	3-6 weeks for survivors.	8% to more than 30%.	No specific therapy. Vaccine available.	Highly contagious. Airborne transmission very high.
Dengue fever.	Dengue fever virus.	Virus	Humans and monkeys.	4-10 days. Commonly 5 to 8 days.	Sudden onset, fever, chills, headache, backache, joint and muscle pains, weakness, prostration, enlargement of lymph nodes, and sometimes a skin rash.	1-3 weeks	Less than 1%	No specific therapy. Supportive treatment. Vaccine available.	Very incapacitating.
Epidemic typhus.	*Rickettsia prowazeki.*	Rickettsia	Humans	10-12 days	Acute infectious disease characterized by severe headache, sustained high fever, general pains, and a skin rash. Transmission is by the body louse. Not communicable directly from man to man.	Variable	10-40%	Antibiotics. Supportive therapy. Vaccine available.	One attack usually confers immunity.

7.2. Typical Diseases Injurious to Man and Animals—Continued

Disease	Causative organism	Type of organism	Host	Incubation period	Symptoms	Duration of effects	Mortality (untreated)	Treatment	Remarks
Rinderpest (cattle plague).	Rinderpest virus.	Virus	Cattle, oxen, water buffaloes, sheep, goats, camels, and swine.	3-9 days	Highly contagious and fatal disease. Sudden onset, high fever, inflammation of the digestive tracts, erosion of the mucous membranes of the mouth, bloody diarrhea, emaciation, and death.	4-8 days	15-95%	Antiserum, antibiotics, supportive therapy.	Recovered animals usually immune to second attacks. Highly contagious from animal to animal.
Histoplasmosis.	*Histoplasma capsulatum.*	Fungus	Humans and animals.	5-18 days	Chronic, local, or systemic infectious disease. Tuberculosis-like lesions of the lungs, involvement of internal organs (spleen and liver). Transmission is usually by inhalation of spores.	Variable	Progressive form usually fatal. More than 1% develop progressive disease.	No immunization. Amphotericin appears to be of some value.	Noncontagious disease.
Botulism	*Clostridium botulinum.*	Bacteria (toxin).	Humans and animals.	12 to 72 hours after eating food containing toxin.	The toxin of this organism attacks the central nervous system. Vomiting, double vision, difficult breathing, and respiratory paralysis leading to death.	3 to 7 days	65%	Antisera. Polyvalent toxoid available.	Disease is not contagious. Poisoning due to toxin of the bacteria.★

APPENDIX II

CHEMICAL FIRE PLAN APPENDIX TO FIRE SUPPORT PLAN ANNEX

1. Purpose and Scope

The purpose of this appendix is to illustrate a typical chemical fire plan for a division. The examples set forth those aspects of chemical fire planning that are of particular concern to the division chemical officer.

★2. Format

The chemical fire plan will appear as an appendix to the unit fire support plan. The fire support plan is an annex to the operations order and is the basic document for planning, coordinating, and integrating all available fire support for support of ground operations. Guidance on the general concept for employment of chemical fires will normally be stated in paragraph 3*a*, CONCEPT OF THE OPERATION. In addition to this general guidance, an entire subparagraph of paragraph 3, fire support plan, is devoted to chemical fires. This paragraph will contain detailed information relative to employment of chemical fires and will be supported by the chemical fire plan, an appendix to the fire support plan. The format for the chemical fire plan is the same as that for the artillery fire plan: a graphic overlay showing target concentration, target lists, and schedules of fires. The chemical fire plan should be as brief and concise as possible. There will be occasions in which the preparation of a chemical fire plan will not be necessary. This is particularly true when there are only a few chemical targets considered for attack. In such cases all details of chemical fire support coordination will be stated in the chemical subparagraph of the fire support plan, with the targets graphically portrayed on the artillery fire plan. The chemical subparagraph of the fire support plan must, however, direct attention to the artillery fire plan.★

★3. Composition

a. The chemical fire plan will consist of a heading, references, acknowledgment, and signature (fig. 4). Written material will be kept to a minimum. Information normally outlined in the fire support plan will not be repeated in the chemical fire plan. Minimum essential items appearing in the chemical fire plan are illustrated in figure 4 and will be:

(1) The graphical portrayal of targets. Targets are shown as tick marks, the center of the tick being the center of the target. Concentrations are numbered in the upper right-hand corner of the tick.

(2) A target list. The target list contains those concentrations that are planned. (The chemical officer will provide all the data in the target list, with the exception of the firing units.)

(3) A schedule of fire. The schedule of fires shows the concentrations to be fired (above the horizontal bar), the time to commence firing and the time firing must be completed (horizontal bar), and the amount of ammunition to be expended per unit (below the horizontal bar).

b. Additional information which may appear on the chemical fire plan:

(1) A table of groups of fires. The table of groups of fires lists the fires planned to cover a single tactical locality too large to be covered by a single concentration.

(2) Marginal information (overlay). Information placed on the margin of the overlay which is considered pertinent and necessary.★

★*Figure 4.* (Superseded) *Example chemical fire plan.* (Located in back of manual)

[Next page is 175]

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Appendix 3 (Chemical Fire Plan) to Annex C (Fire Support Plan) to OPORD 25.

References: Map, GERMANY, 1:1000,000

1. SITUATION

a. Enemy forces: Annex A, Intelligence.

b. Friendly forces: Annex C, Fire Support Plan.

c. Attachments: 1st Plat., 11th Cml Direct Spt Co.

2. MISSION

Employ toxic chemicals on enemy assault formation, defensive positions, assembly areas, and reserves to facilitate initial penetration and exploitation.

3. EXECUTION

a. Concept of chemical support.

(1) A chemical preparation will be fired commencing at H-18 minutes, employing nonpersistent agent GB to produce casualties.

(2) Persistent effect toxic agents HD or VX to be fired by rockets and/or aircraft to block enemy escape routes and protect flanks of attacking friendly forces by contaminating terrain and producing delayed casualties.

b. Units to participate in chemical fires.

(1) Air—9th TAF. See target list.

(2) Artillery. See target list.

c. Coordinating instructions.

(1) Weather.

(a) Wind speed and direction: 3-5 mph, SW.

(b) Average temperature: 50° F.

(c) Conditions favor our use cml agents.

(2) 2/50 Arty draw M91 lchrs from 902d Ord Gp (820330) NLT 222000 May. M55 rkts from ASP 169 (825335).

(3) Troops entering toxic impact areas will be masked, initially.

4. ADMINISTRATION AND LOGISTICS. ADMINO 9.

Cml ammo avail supply rate—See Annex C (Fire Support Plan).

5. COMMAND AND SIGNAL. Annex D, Signal, to OPORD 25.

Index 3, SOI

EGGERMAN
Maj Gen

Acknowledge:

Distribution: A
2d Corps
9th TAF
11th Armd Div
101st Arty Gp

OFFICIAL:
/s/Weller
WELLER
G3

Unit	H-18	H-17	H-16	H-15
2/50 Arty	ACN 1 4 Rpls (M55)			
2/50 Arty	ACN 2 4 Rpls (M55)			
2/50 Arty	ACN 3 4 Rpls (M55)			
2/50 Arty	ACN 4 10 Rpls (M55)			
1/20 Arty	ACN 5 2 Rkts (M79)			
1/20 Arty	ACN 6 2 Rkts (M79)			
2/50 Arty	ACN 7 6 Rpls (M55)			
1/82 Arty	ACN 8 2 Rkts (M79)			
1/82 Arty	ACN 9 2 Rkts (M79)			
2/50 Arty	ACN 10 2 Rpls (M55)			
2/50 Arty	ACN 11 6 Rpls (M55)			
1/18 Arty	ACN 12 24 Rds (155mm)			
1/50 Arty	ACN 13 24 Rds (155mm)			

Target Number	Description	Coordinates	Altitude (meters)	Bearing (degrees)	Target Size Meters	Hectares	wpns /Munition	Firing Units	Remarks (Effects Desired)
ACN 1	Trps in foxholes w/overhead cover	980556	370	45°	500 x 1800	90	4 Lchr M91 w/GB Rkt	2/50 Arty	Imm Casualties (Elliptical Tgt)
ACN 2	Trps in foxholes w/overhead cover	985535	330	75°	500 x 1700	85	4 Lchr M91 w/GB Rkt	2/50 Arty	Imm Casualties (Elliptical Tgt)
ACN 3	Trps in bunkers, anti-tank emplacement	968576	315	30°	600 x 1600	94	4 Lchr M91 w/OB Rkt	2/50 Arty	Imm Casualties (Elliptical Tgt)
ACN 4	Trps in foxholes	058468	320	25°	1000 x 2500	250	10 Lchr M91 w/GB Rkt	2/50 Arty	Imm Casualties (Elliptical Tgt)
ACN 5	Tank assy area	965696	390	45°	1000 x 1000	100	2-HJ w/GB whd	1/20 Arty	Imm Casualties (Circular Tgt)
ACN 6	Bn hqs area	963678	310	45°	1000 x 1000	100	2-HJ w/GB whd	1/20 Arty	Imm Casualties (Circular Tgt)
ACN 7	Bn hqs area and hvy wpns emplacement	000550	420	90°	750 x 2000	150	6 Lchr M91 w/GB Rkt	2/50 Arty	Imm Casualties (Elliptical Tgt)
ACN 8	Bn hqs area	012598	460	45°	1000 x 1000	100	2-HJ w/OB whd	1/82 Arty	Imm Casualties (Circular Tgt)
ACN 9	Armd unit hqs area	083584	360	30°	800 x 1200	96	2-HJ w/OB whd	1/82 Arty	Imm Casualties (Elliptical Tgt)
ACN 10	Bn hqs area	096536	320	90°	700 x 700	49	2 Lchr M91 w/OB Rkt	2/50 Arty	Imm Casualties (Circular Tgt)
ACN 11	Trps in foxholes w/overhead cover	953595	380	115°	700 x 2100	147	6 Lchr M91 w/GB Rkt	2/50 Arty	Imm Casualties (Elliptical Tgt)
ACN 12	Trps in bunkers	023570	490	140°	100 x 150	1.5	24 rds GB - 155mm	1/18 Arty	Imm Casualties (Elliptical Tgt)
ACN 13	Trps in bunkers	017576	430	135°	100 x 150	1.5	24 rds GB - 155mm	1/50 Arty	Imm Casualties (Elliptical Tgt)
ACN 14	Open terrain (denial)	788717	160	45°	400 x 600	24	6 MC-1 bombs - VX	1 sortie 9th TAF	On Call. Contaminate area north of bridge (Elliptical Tgt)
ACN 15	Open terrain (denial)	739716	150	60°	400 x 600	30	6 MC-1 bombs - VX	1 sortie 9th TAF	On Call. Contaminate area north of bridge. (Elliptical Tgt)
ACN 16	Open terrain (denial)	734721	150	60°	400 x 600	24	6 MC-1 bombs - VX	1 sortie 9th TAF	On Call. Contaminate area north of bridge. (Bridge to be destroyed with HE from air)(Elliptical Tgt)
ACN 17	Open terrain (denial)	710742	150	75°	400 x 700	28	6 MC-1 bombs - VX	1 sortie 9th TAF	On Call. Contaminate area. (Elliptical Tgt)

(Classification)

★*Figure 4.* (Superseded) *Example chemical fire plan.*

★*Figure 4*